Nokia Customer Care

Service Manual

RM-398; RM-399 (Nokia 7510 Supernova; L3&4)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	09/2008	ET	

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The availability of particular products may vary by region.

IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

Company policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Ion batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

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Nokia 7510 Supernova; L3&4 Service Manual Structure

1 General Information
2 Service Devices and Service Concepts
3 BB Troubleshooting and Manual Tuning Guide
4 RF Troubleshooting
5 System Module
Glossary

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1 — General Information

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Product selection

RM-398/399 is a GSM quadband handportable phone with a fold form factor. It supports EGSM850/900/1800/1900 bands, and CSD/HSCSD and GPRS/EGPRS data bearers.

Note: RM-399 also supports WLAN and voice over IP/UMA.

For GPRS/EGPRS networks RM-398/399 is a Class B EGPRS MSC 32 (5 Rx + 3 Tx, max sum 6), which means a maximum downlink speed of 296 kbit/s and uplink speed of 177.6 kbit/s. RM-398/399 also supports Dual Transfer Mode (DTM) for simultaneous voice and packet data connection in GSM/EDGE networks; simple class A, multi slot class 11, (4 Rx + 3 Tx, max sum 5), downlink speed of 177.6 kbit/s and uplink speed of 118.4 kbit/s.

RM-398/399 is an MMS (Multimedia Messaging Service) enabled multimedia device. The MMS implementation follows the OMA MMS standard release 1.3. RM-398/399 also supports Bluetooth 2.1 standard with the stereo audio profiles.

RM-398/399 has a large 2.2'' QVGA (320 x 240 pixels) TFT main display with 16 million colors, and a hidden-until-lit secondary monochrome display (128 x 160 pixels). The device also has a 2 Megapixel camera with LED flash, NIPS and smooth 4 x digital zoom.

RM-398/399 supports the 3rd generation S40 UI and S40 OSS web browser, which brings desktop-like Web browsing experience to mobile devices.

RM-398/399 also supports MIDP Java 2.1, providing a good platform for compelling 3rd party applications.

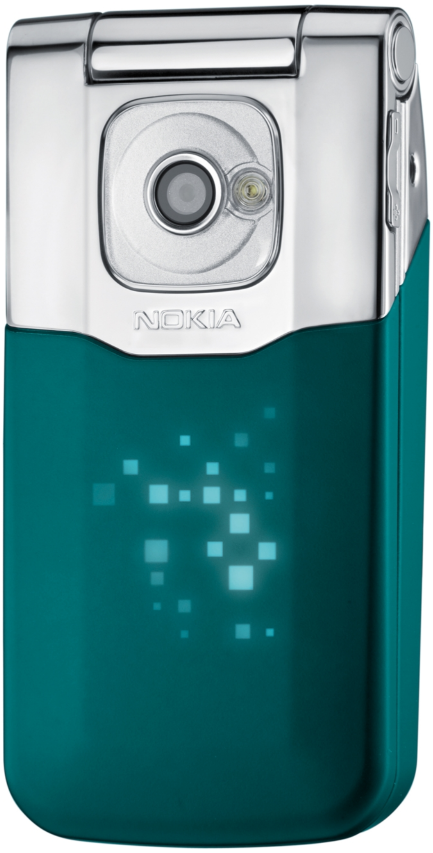

Figure 1 View of RM-398/399

Product features and sales package

Bearers and transport

- GSM/EDGE Class B, Multi slot class 32

- GPRS/EGPRS Class B, Multi slot class 32
- GSM/EDGE Dual Transfer Mode (DTM) class A, multi slot class 11

Connectivity

- Bluetooth 2.1 with stereo audio profiles
- USB2.0 Full Speed with micro USB interface
- MicroSD memory card - support up to 8GB
- 2.5 mm AV Connector
- 2 mm charging connector
- RM-399: WLAN & voice over IP/UMA

Display

- Large 2.2'' QVGA (320x240 pixels) TFT main display with 16 million colors
- Hidden-until-lit secondary monochrome display with landscape mode (128 x 160 pixels)

Imaging and video

- Integrated 2 Megapixel camera with LED flash, NIPS and smooth 4 x digital zoom
- Video recording in QCIF (15fps)
- Video player with 3GPP H.263 playback and streaming, recording and MPEG4 playback

Music

- Music Player for WMA (WM9, WMA10pro), RealAudio, MP3, AAC and eAAC+
- Ring tones: Video, WAV, MP3, AAC, eAAC+ and 64 polyphonic ringing tones
- FM RDS stereo radio / Visual radio™

Productivity

Context management

- OMA DRM version 2.0
- Organizer (Calendar + To-Do + Active Notes)
- PC Suite
- Active Standby
- Local/remote SyncML data sync
- Web Browser (OSS), Java ™ MIDP 2.0, XHTML browsing over TCP/IP

Messaging

- Email: Max. message size is 600 kB (sending & receiving)
- OMA MMS 1.3 (600kB MMS size), SMIL
- Nokia Xpress Audio Messaging (AMS)

Voice

- Speech codec support for HR, FR, EFR, AMR and AMR-WB

Add-on software framework

- Nokia Series 40, 3rd edition
- Java: MIDP2.1

Additional features

- Adobe Flash Lite 3.0
- Vibrating alert
- Reminder light (next to the camera)
- Nokia Maps 1.2 support

Sales package

List of sales pack contents, there may be sales area variations.

- Transceiver RM-398/399
- Battery (BL-5BT/870 mAh)
- Charger (AC-3)
- HS-47 headset
- User Guide
- MicroSD card 512 MB (MU-28)
- Two sets of Xpress-on covers

Product and module list

Module name	Type code	Notes
System/RF module	2LWA	
Board to board connector	2LZA	
UI flex	2LXA	

Mobile enhancements

Table 1 Audio

Enhancement	Type
Audio Adapter (2.5 to 3.5mm)	AD-52
Wired headsets	HS-40
	HS-47
	HS-81
	HS-102

Enhancement	Type
Wireless headsets	HS-12W
	HS-24W
	HS-25W
	HS-26W
	HS-34W
	HS-38W
	HS-39W
	HS-50W
	HS-51W
	HS-52W
	HS-57W
	HS-58W
	HS-59W
	HS-64W
	HS-71W
	HS-72W
	HS-76W
	HS-78W
	HS-79W
	HS-80W
	HS-86W
	HS-89W
	HS-91W
	HS-94W
	HS-95W
	HS-96W
	HS-100W
	HS-121W

Table 2 Car

Enhancement	Type
Car kit phone	N616
Display car car kit	CK-15W
FM transmitter	CA-119
Multimedia car kit	CK-20W

Enhancement	Type
Wireless plug-in car handsfree	HF-6W
	HF-33W
	HF-34W
	HF-36W

Table 3 Data

Enhancement	Type
MicroSD card, 256MB	MU-27
MicroSD card, 512 MB	MU-28
MicroSD card, 1 GB	MU-22
MicroSD card, 2 GB	MU-37
MicroSD card, 4 GB	MU-41
MicroSD card, 8 GB	MU-43
MicroUSB connectivity adapter cable	CA-101
Wireless GPS Module	LD-4W

Table 4 Music

Enhancement	Type
Wired music speakers	MD-3
	MD-4
	MD-6
Wireless music speakers	MD-5W
	MD-7W
Wireless audio gateway	AD-42W

Table 5 Power

Enhancement	Type
Battery 870mAh	BL-5BT
First aid charger	DC-8
Mobile charger	DC-4
Retractable mobile charger	DC-9
Travel charger	AC-3
	AC-4
	AC-5

Enhancement	Type
	AC-8
USB charger	AC-6C
USB Charger Adapter Cable	CA-100
	CA-100C
Charger adapter	CA-44

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BL-5BT 870 mAh Li-ion battery back	92.5 x 46.4 x 16.7	124	63

Main RF characteristics for GSM850/900/1800/1900 (quadband) and EDGE phones

Table 6 Main RF characteristics

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900 and EDGE
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
Output power	GSM850: +5 ... +33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW

Parameter	Unit
Number of RF channels	GSM850: 124
	GSM900: 194
	GSM1800: 374
	GSM1900: 299
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
Number of EDGE Tx power levels	GSM850 EDGE: 12
	GSM900 EDGE: 12
	GSM1800 EDGE: 14
	GSM1900 EDGE: 14

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-5BT	870	Up to 6h	Up to 300h

Environmental conditions

Temperature conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15ºC...+55ºC	Specifications fulfilled
Reduced performance	-25ºC...-15ºC +55ºC...+70ºC	Operational for shorts periods only
Intermittent operation	-40ºC...-15ºC +70ºC...+85 ºC	Operation not guaranteed but an attempt to operate does not damage the phone.
No operation or storage	<-40ºC...>+85ºC	No storage or operation: an attempt may damage the phone.
Charging allowed	-25ºC...+50ºC	
Long term storage conditions	0ºC...+85ºC	

Humidity

Relative humidity range is 5...95%.

The HW module is not protected against water. Condensed or splashed water might cause malfunction. Any submerge of the phone will cause permanent damage. Long-term high humidity, with condensation, will cause permanent damage because of corrosion.

Vibration

The module should withstand the following vibrations:

- 5 - 10 Hz; +10dB / octave
- 10 - 50 Hz; 5.58 m^2 / s^3 (0.0558 g^2/ Hz)
- 50 - 300 Hz; - 10 dB / octave

ESD strength

Conducted discharge is 8 kV (>10 discharges) and air contact 15 kV (>10 discharges).

The standard for electrostatic discharge is IEC 61000-4-2, and this device fulfils level 4 requirements.

RoHS

This device uses RoHS compliant components and lead-free soldering process.

2 — Service Devices and Service Concepts

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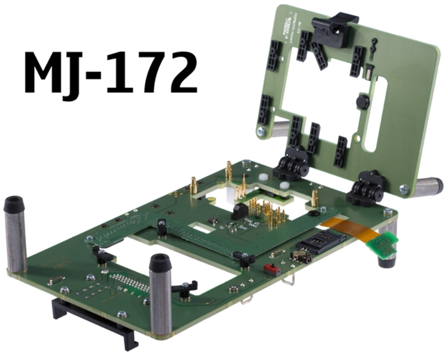
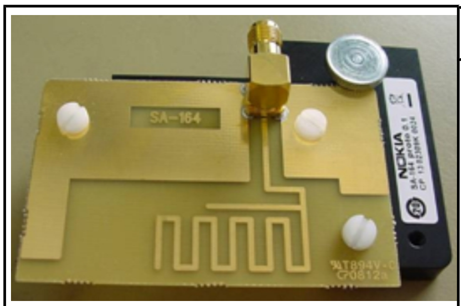
Service devices

Product specific devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-398; RM-399. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">FS-83
 </td><td>FS-83</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">FS-83 is equipped with a clip interlock system
provides standardised interface towards Control Unit
provides RF connection using coupler
multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2">MJ-172
</td><td>MJ-172</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-172 is meant for component level troubleshooting.
The jig includes an RF interface for GSM, Bluetooth and WLAN. In addition, it has the following features:
Provides mechanical interface with the engine module
Provides galvanic connection to all needed test pads in module
Multiplexing between USB and FBUS media, controlled by Vusb
MMC interface
Duplicated SIM connector
Connector for control unit
Access for AV- and USB connectors</td></tr>
<tr><td rowspan="2">RJ-230
 </td><td>RJ-230</td><td>Soldering jig</td><td></td></tr>
<tr><td colspan="3">RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.</td></tr>
</table>



SA-164	RF coupler	

SA-164 is an RF coupler for GSM RF testing. It is used together with SS-46 and SS-62.

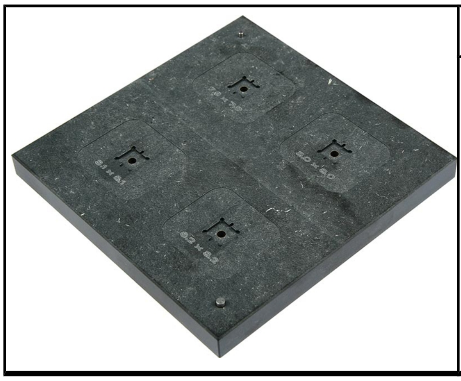
The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-164:

- **Attenuation values for inductive RF coupler SA-164**

Band	Channel	Attenuation RX	Attenuation TX
GSM 850	Low	5	6,7
	Mid	5	6,8
	High	5	6,8
GSM 900	Low	5	5,8
	Mid	5	6
	High	7	6,7
GSM 1800	Low	9	12,2
	Mid	9	11,9
	High	8	10,8
GSM 1900	Low	9	11,1
	Mid	9	10,7
	High	11	11,1

Rework jigs and stencils

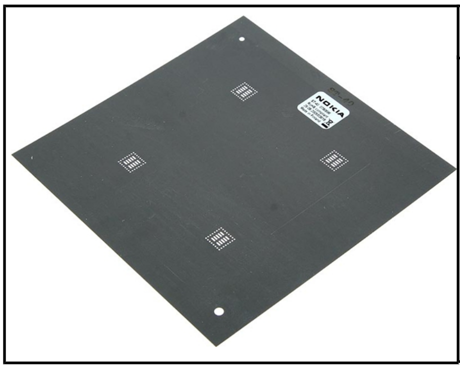
The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-398; RM-399. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.



RJ-184	Rework jig	

RJ-184 is a rework jig used when servicing the microphone (B2150).

It is used together with the ST-61 rework stencil.

	ST-61	Rework stencil	
	ST-61 is a rework stencil used when servicing the microphone (B2150). It is used together with the rework jig RJ-184.		

General devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-398; RM-399. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	AC-33	Power supply	
	Universal power supply for FPS-10; included in the FPS-10 sales package.		
	AC-35	Power supply	
	Universal power supply for FPS-21; included in the FPS-21 sales package. Input 100V...230V 50Hz...60Hz, output voltage of 12 V and output current up to 3 A.		
	ACF-8	Universal power supply	
	The ACF-8 universal power supply is used to power FLS-5.		

CU-4

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

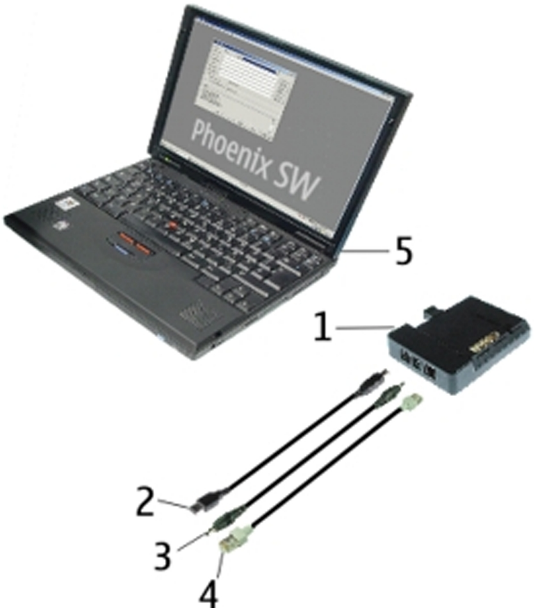
1 Connect a service tool (jig, flash adapter) to CU-4.

2 Connect CU-4 to your PC with a USB cable.

3 Connect supply voltage (12 V)

4 Connect an FBUS cable (if necessary).

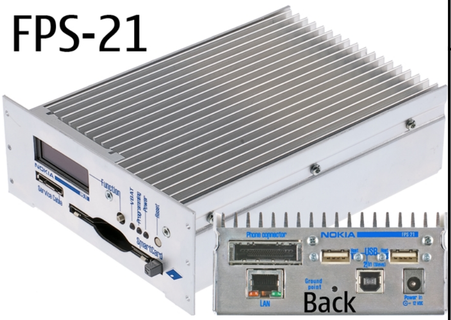
5 Start Phoenix service software.



Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

<table>
<tr><td rowspan="2"> </td><td>FLS-5</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.
Note: FLS-5 can be used as an alternative to PKD-1.</td></tr>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:
• PC
• Control unit
• Flash adapter
• Smart card
FPS-10 flash prommer features:
• Flash functionality for BB5 and DCT-4 terminals
• Smart Card reader for SX-2 or SX-4
• USB traffic forwarding
• USB to FBUS/Flashbus conversion
• LAN to FBUS/Flashbus and USB conversion
• Vusb output switchable by PC command
FPS-10 sales package includes:
• FPS-10 prommer
• Power Supply with 5 country specific cords
• USB cable
Note: FPS-21 is substitute FPS-10 if FPS-10 has not been set up.</td></tr>
</table>



FPS-21	Flash prommer	

FPS-21 sales package:

- FPS-21 prommer
- AC-35 power supply
- CA-31D USB cable

FPS-21 interfaces:

Front

- Service cable connector

  Provides Flashbus, USB and VBAT connections to a mobile device.
- SmartCard socket

  A SmartCard is needed to allow DCT-4 generation mobile device programming.

Rear

- DC power input

  For connecting the external power supply (AC-35).
- Two USB A type ports (USB1/USB3)

  Can be used, for example, for connecting external storage memory devices or mobile devices
- One USB B type device connector (USB2)

  For connecting a PC.
- Phone connector

  Service cable connection for connecting Flashbus/FLA.
- Ethernet RJ45 type socket (LAN)

  For connecting the FPS-21 to LAN.

Inside

- Four SD card memory slots

  For internal storage memory.

  Note: In order to access the SD memory card slots inside FPS-21, the prommer needs to be opened by removing the front panel, rear panel and heatsink from the prommer body.

  Note: FPS-10 can be used for flashing instead of FPS-21 if necessary.

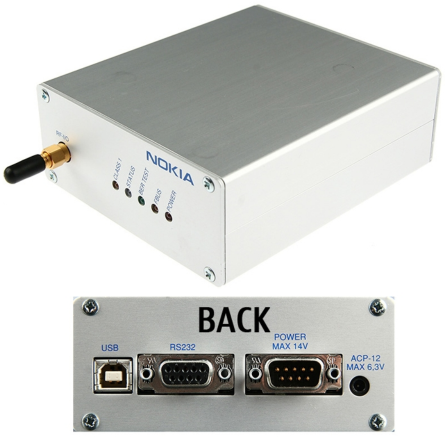
JXS-1	RF shield box	

Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal.

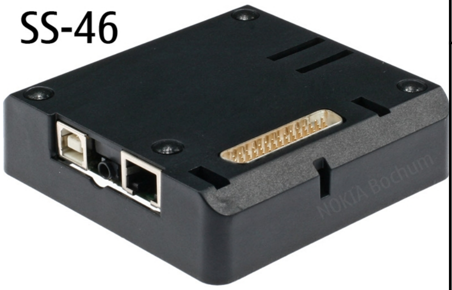
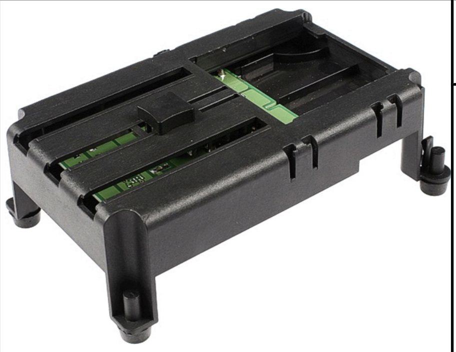
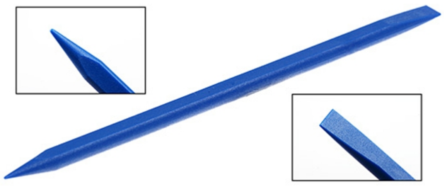
The shield box is not an active device, it contains only passive filtering components for RF attenuation.

<table>
<tr><td rowspan="2">
DESkey
www.des.co.uk

</td><td>PK-1</td><td>Software protection key</td><td></td></tr>
<tr><td colspan="3">PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.
PK-1 is meant for use with a PC that does not have a series interface.
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</td></tr>
<tr><td rowspan="2">
DESkey
www.des.co.uk

</td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2">
</td><td>SB-6</td><td>Bluetooth test and interface box (sales package)</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .
Sales package includes:
• SB-6 test box
• Installation and warranty information</td></tr>
<tr><td rowspan="2">
NOKIA
SPS-1 0770381
MADE IN FINLAND

</td><td>SPS-1</td><td>Soldering Paste Spreader</td><td></td></tr>
<tr><td colspan="3">The SPS-1 allows spreading of solder to the LGA components pads over the rework stencils.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>SPS-2</td><td>Soldering paste spreader</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2"> </td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers.</td></tr>
<tr><td rowspan="2"> </td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the flash adapter and FPS-10.</td></tr>
<tr><td rowspan="2"></td><td>SS-62</td><td>Generic flash adapter base for BB5</td><td></td></tr>
<tr><td colspan="3">• generic base for flash adapters and couplers
• SS-62 equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using galvanic connector or coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>SS-93</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SS-93 is used for opening JAE connectors.</td></tr>
<tr><td rowspan="2"> </td><td>SX-4</td><td>Smart card</td><td></td></tr>
<tr><td colspan="3">SX-4 is a BB5 security device used to protect critical features in tuning and testing.
SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</td></tr>
</table>

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-398; RM-399. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

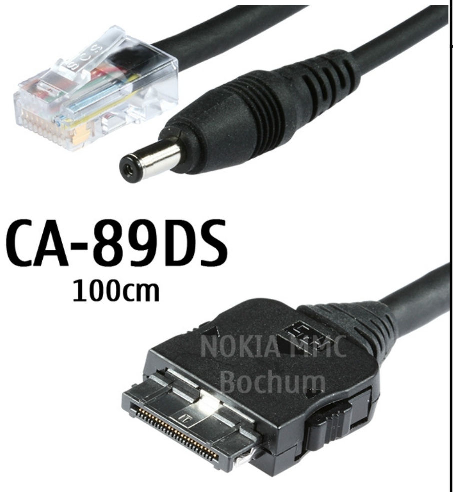
<table>
<tr><td rowspan="2">

CA-101
100cm

</td><td>CA-101</td><td>Micro USB cable</td><td></td></tr>
<tr><td colspan="3">The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.</td></tr>
<tr><td rowspan="2"> </td><td>CA-128RS</td><td>RF tuning cable</td><td></td></tr>
<tr><td colspan="3">Product-specific adapter cable for RF tuning.

- **Table 7 Attenuation values**

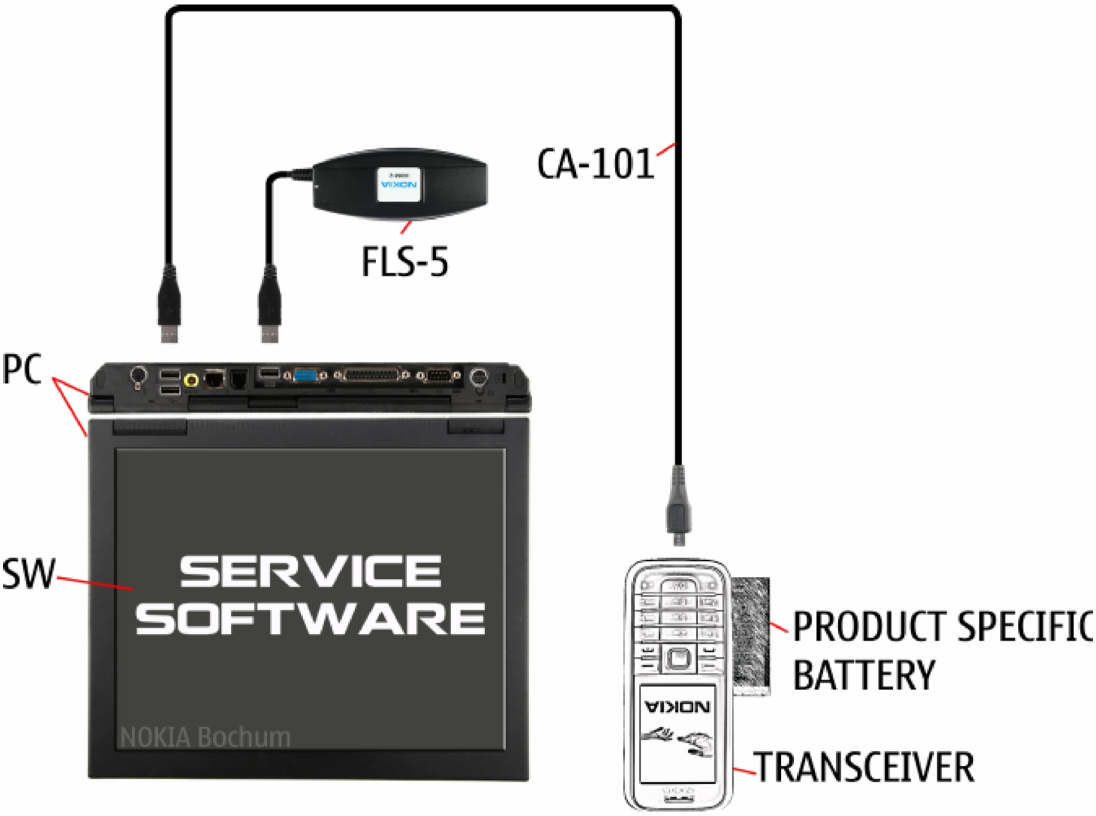
<table>
<tr><th>Band</th><th>Attenuation Rx</th></tr>
<tr><td>GSM850/900</td><td>0.30 dB</td></tr>
<tr><td>GSM1800</td><td>0.40 dB</td></tr>
<tr><td>GSM1900</td><td>0.45 dB</td></tr>
<tr><td>WLAN 2.4GHz</td><td>0.40 dB</td></tr>
</table></td></tr>
<tr><td rowspan="2"> </td><td>CA-31D</td><td>USB cable</td><td></td></tr>
<tr><td colspan="3">The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>CA-35S</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.</td></tr>
<tr><td rowspan="2"> </td><td>CA-89DS</td><td>Cable</td><td></td></tr>
<tr><td colspan="3">Provides VBAT and Flashbus connections to mobile device programming adapters.</td></tr>
<tr><td rowspan="2"> </td><td>DAU-9S</td><td>MBUS cable</td><td></td></tr>
<tr><td colspan="3">The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.
Note: Docking station adapters valid for DCT4 products.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.</td></tr>
<tr><td rowspan="2"> </td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"> </td><td>XRS-6</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector approximately 610 mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
</table>

Service concepts

POS (Point of Sale) flash concept


CA-101
FLS-5
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Type	Description
Product specific tools	
BL-5BT	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	Micro USB cable

Flash concept with FPS-10

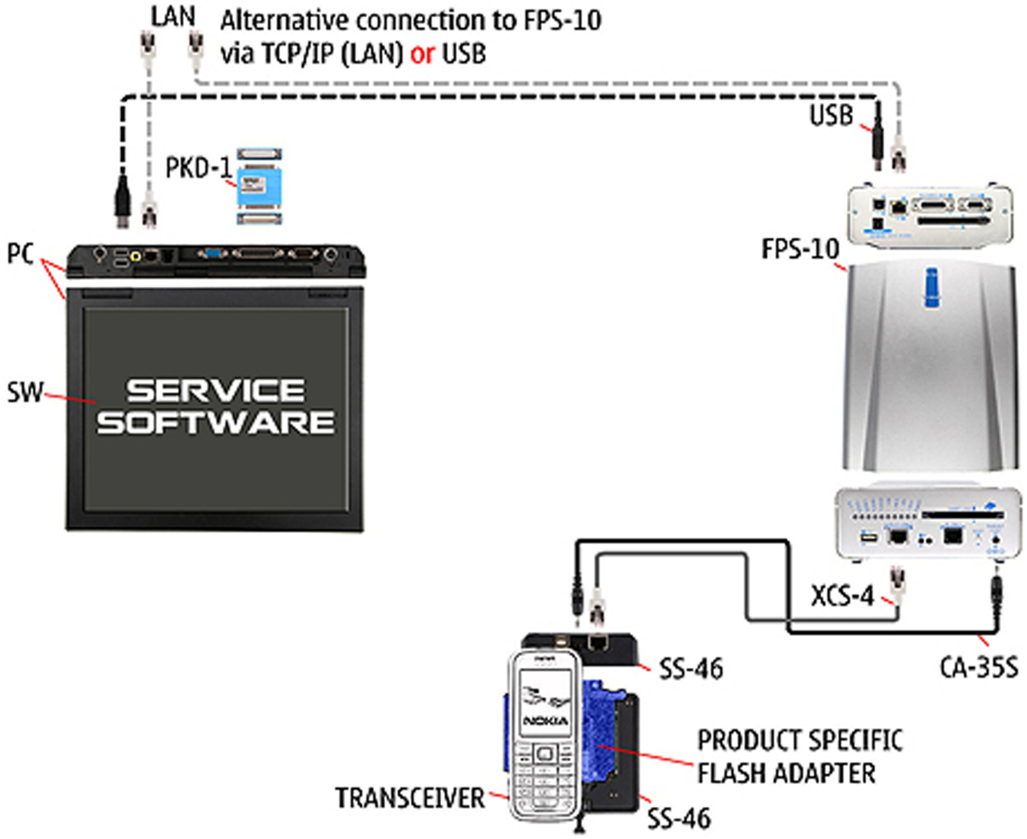

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
SW
SERVICE
SOFTWARE
FPS-10
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 2 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-83	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

Flash concept with FPS-21

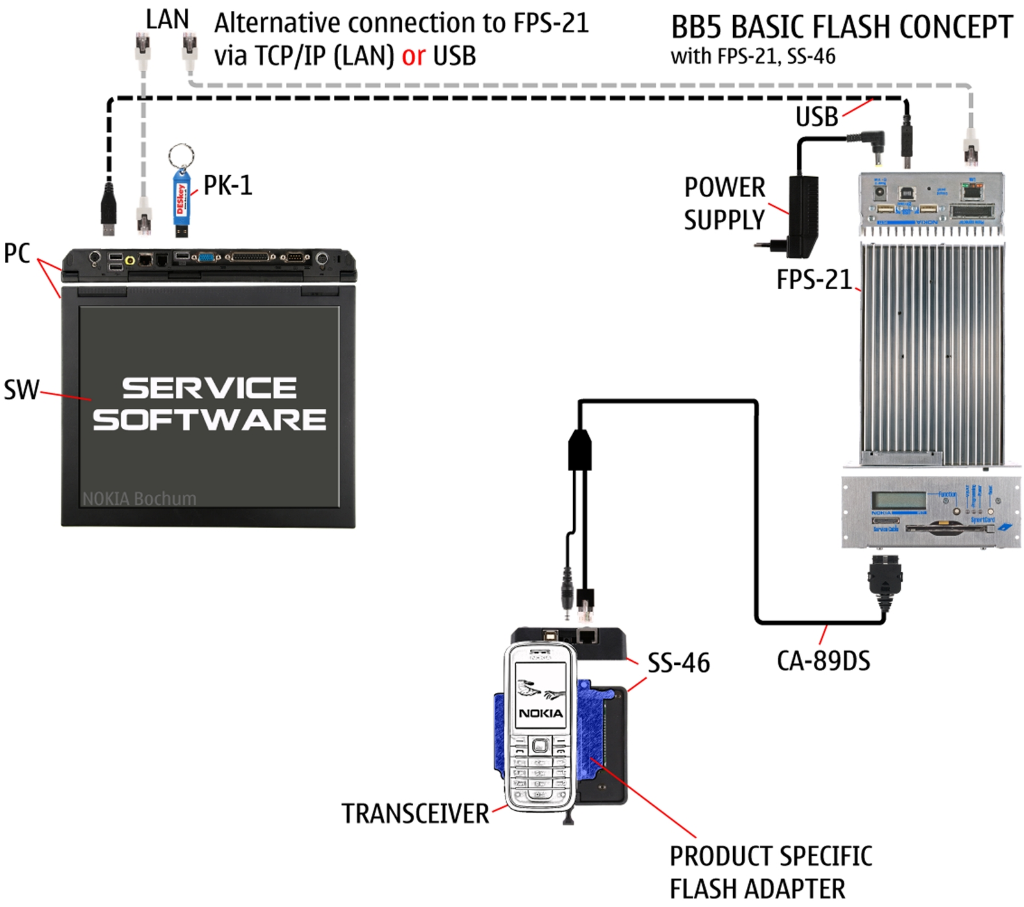

LAN
Alternative connection to FPS-21
via TCP/IP (LAN) or USB
BB5 BASIC FLASH CONCEPT
with FPS-21, SS-46
USB
PK-1
POWER
SUPPLY
PC
FPS-21
SW
SERVICE
SOFTWARE
NOKIA Bochum
SS-46
CA-89DS
TRANSCEIVER
PRODUCT SPECIFIC
FLASH ADAPTER

Figure 3 Basic flash concept with FPS-21

Type	Description
Product specific devices	
FS-83	Flash adapter
Other devices	
FPS-21	Flash prommer box
AC-35	Power supply
PK-1/PKD-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Service cable
	USB cable

CU-4 flash concept with FPS-10

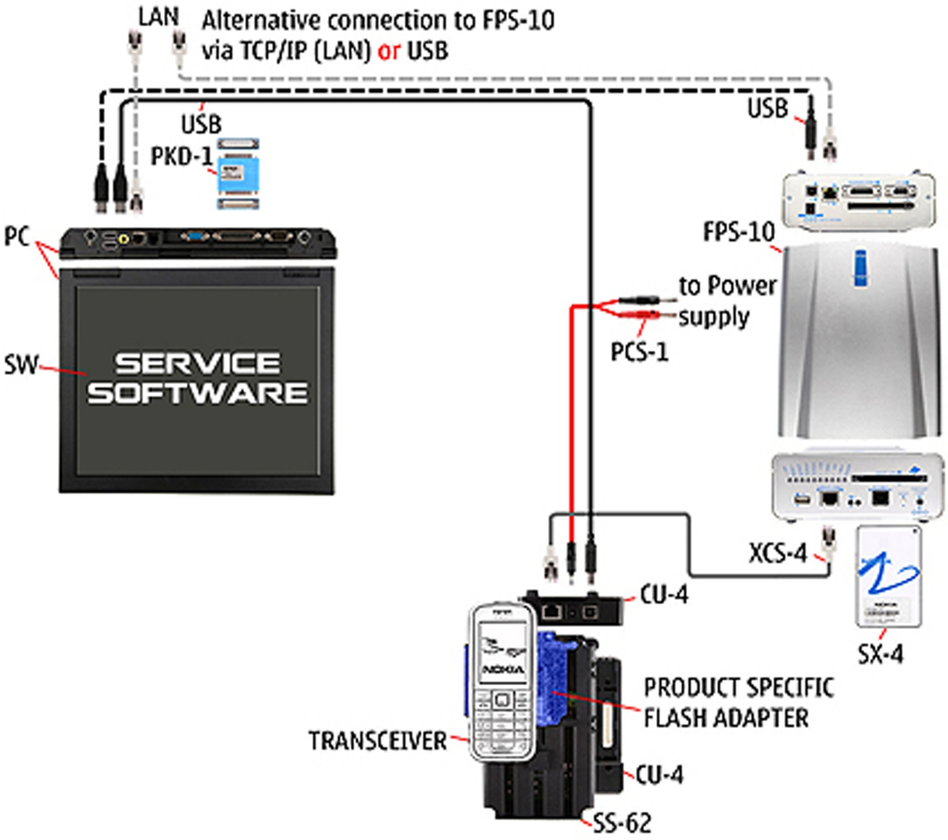

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
SW
SERVICE SOFTWARE
USB
FPS-10
to Power supply
PCS-1
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-83	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

CU-4 flash concept with FPS-21

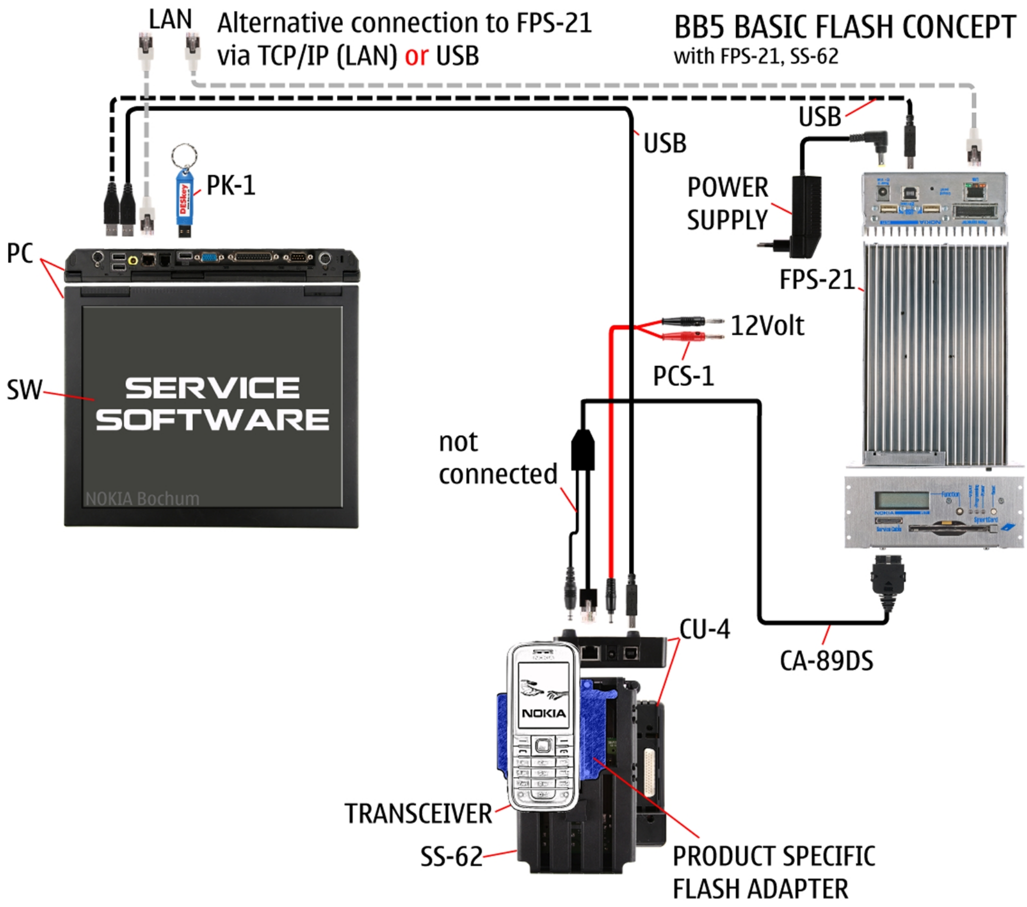

LAN
Alternative connection to FPS-21
via TCP/IP (LAN) or USB
BB5 BASIC FLASH CONCEPT
with FPS-21, SS-62
USB
USB
PK-1
POWER
SUPPLY
PC
FPS-21
12Volt
PCS-1
SW
SERVICE
SOFTWARE
NOKIA Bochum
not
connected
CU-4
CA-89DS
TRANSCEIVER
SS-62
PRODUCT SPECIFIC
FLASH ADAPTER

Figure 5 CU-4 flash concept with FPS-21

Type	Description
Product specific devices	
FS-83	Flash adapter
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
AC-35	Power supply
PK-1/PKD-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card (for DCT-4 generation mobile device programming)
	PC with Phoenix service software
Cables	
PCS-1	Power cable
CA-89DS	Service cable
	Standard USB cable

Type	Description
	USB cable

Module jig service concept

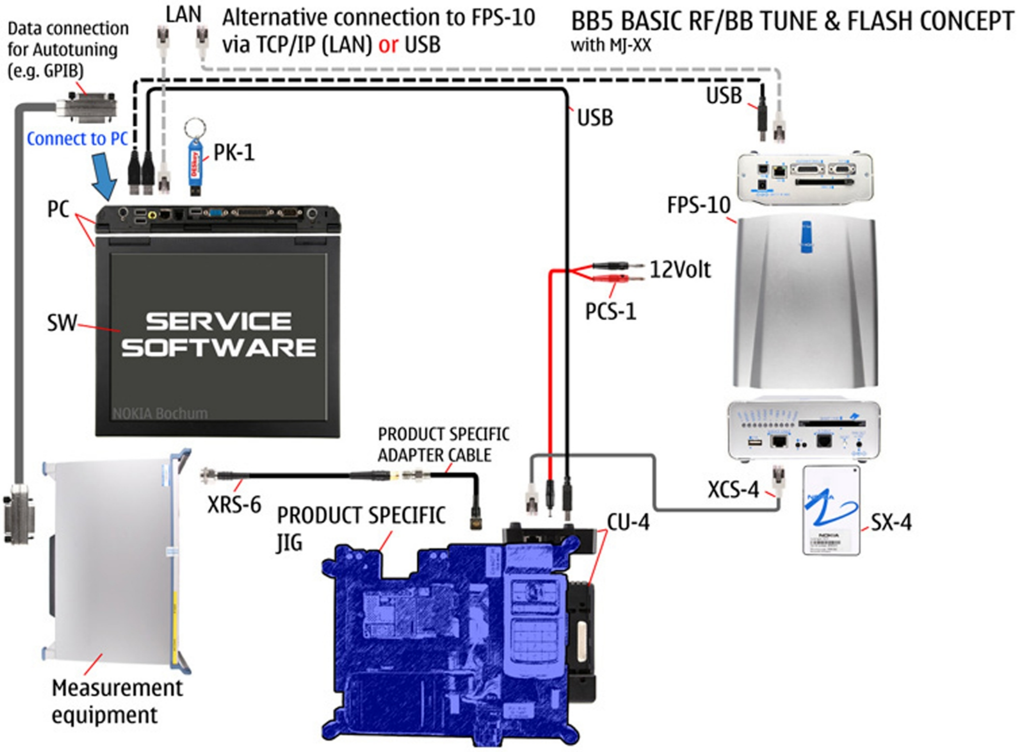

Data connection for Autotuning (e.g. GPIB)
LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
BB5 BASIC RF/BB TUNE & FLASH CONCEPT
with MJ-XX
USB
USB
Connect to PC
PK-1
PC
FPS-10
12Volt
PCS-1
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC ADAPTER CABLE
XRS-6
PRODUCT SPECIFIC JIG
CU-4
XCS-4
SX-4
Measurement equipment

Figure 6 Module jig service concept

Type	Description
Phone specific tools	
MJ-172	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment
Cables	
CA-128RS	RF service cable (product-specific adapter cable)
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable

Type	Description
	USB cable
	GPIB control cable

RF testing concept with RF coupler

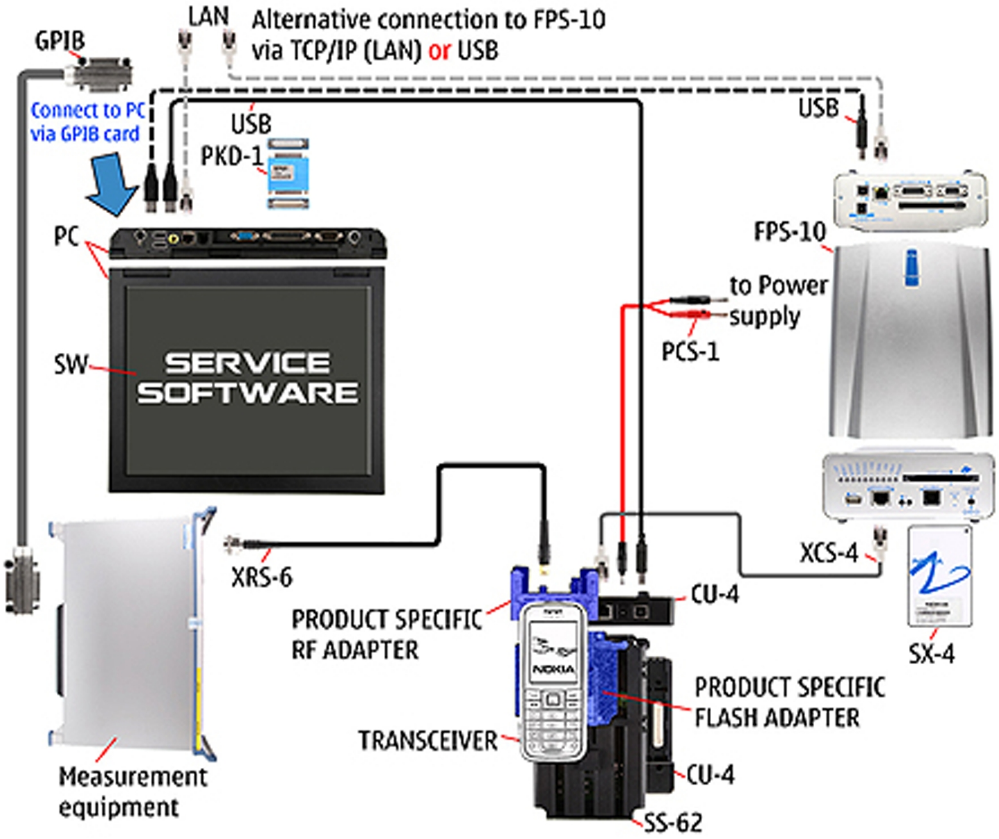

GPIB
LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
Connect to PC via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power supply
PCS-1
SW
SERVICE SOFTWARE
XCS-4
XRS-6
CU-4
PRODUCT SPECIFIC RF ADAPTER
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement equipment
SS-62

Figure 7 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-83	Flash adapter
SA-164	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	

Type	Description
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

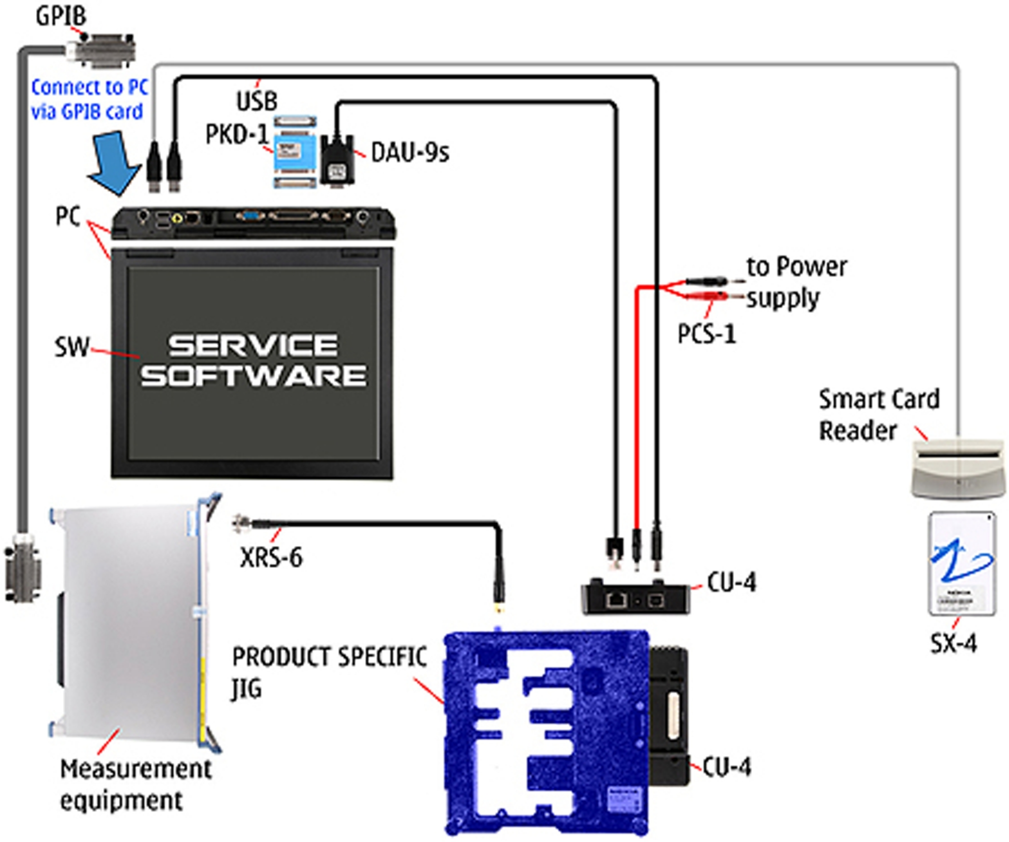

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
to Power supply
PCS-1
SW
SERVICE SOFTWARE
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 8 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-172	Module jig
Other devices	
CU-4	Control unit
PK-1/PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader

Type	Description
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Bluetooth testing concept with SB-6

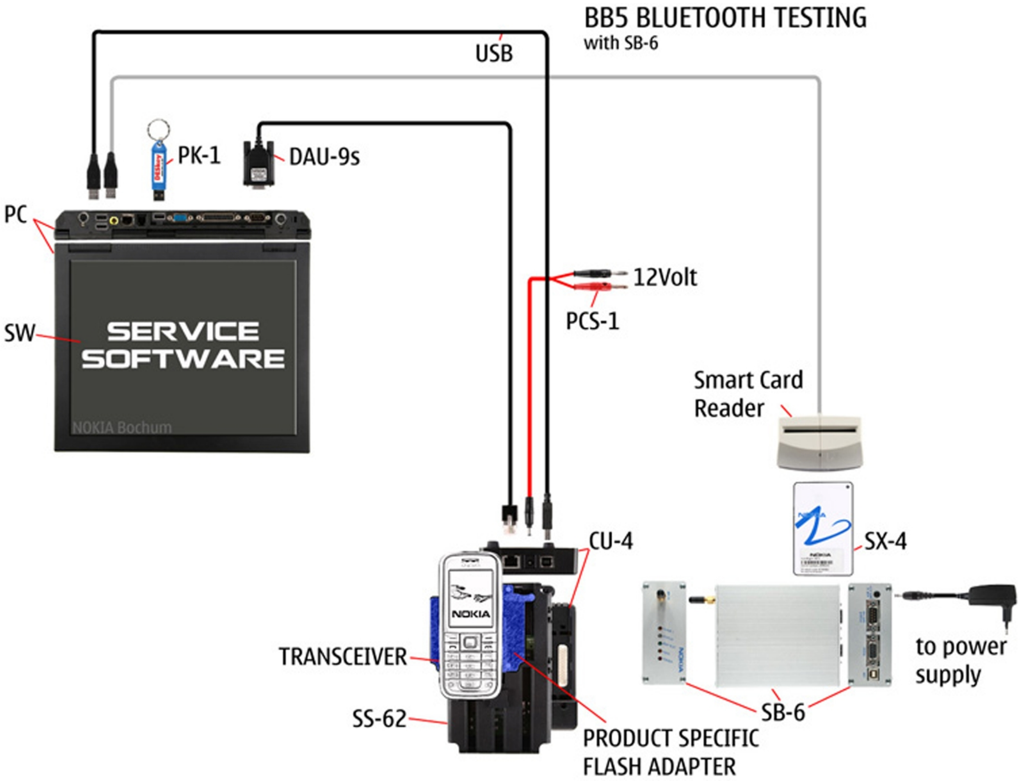

BB5 BLUETOOTH TESTING
with SB-6
USB
PK-1
DAU-9s
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
12Volt
PCS-1
Smart Card Reader
CU-4
SX-4
TRANSCEIVER
SS-62
to power supply
SB-6
PRODUCT SPECIFIC FLASH ADAPTER

Figure 9 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
FS-83	Flash adapter
Other devices	
CU-4	Control unit
SS-62	Flash adapter base
PK-1	SW security device
SX-4	Smart card
SB-6	Bluetooth test and interface box

Type	Description
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
	USB cable

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3 — BB Troubleshooting and Manual Tuning Guide

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    Introduction to acoustics troubleshooting 3–32
    Earpiece troubleshooting 3–34
    IHF troubleshooting 3–35
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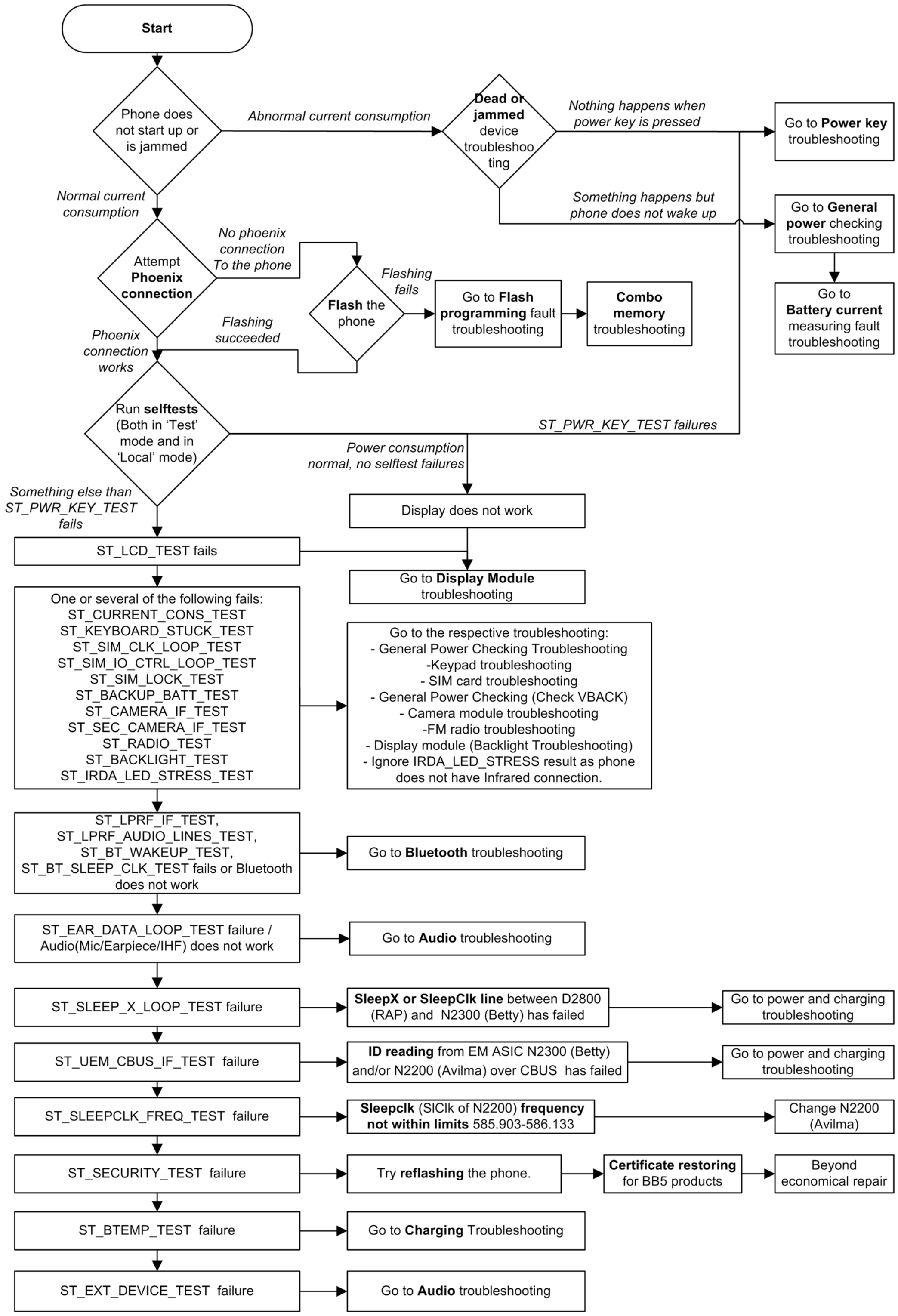
Baseband self tests in Phoenix

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.*

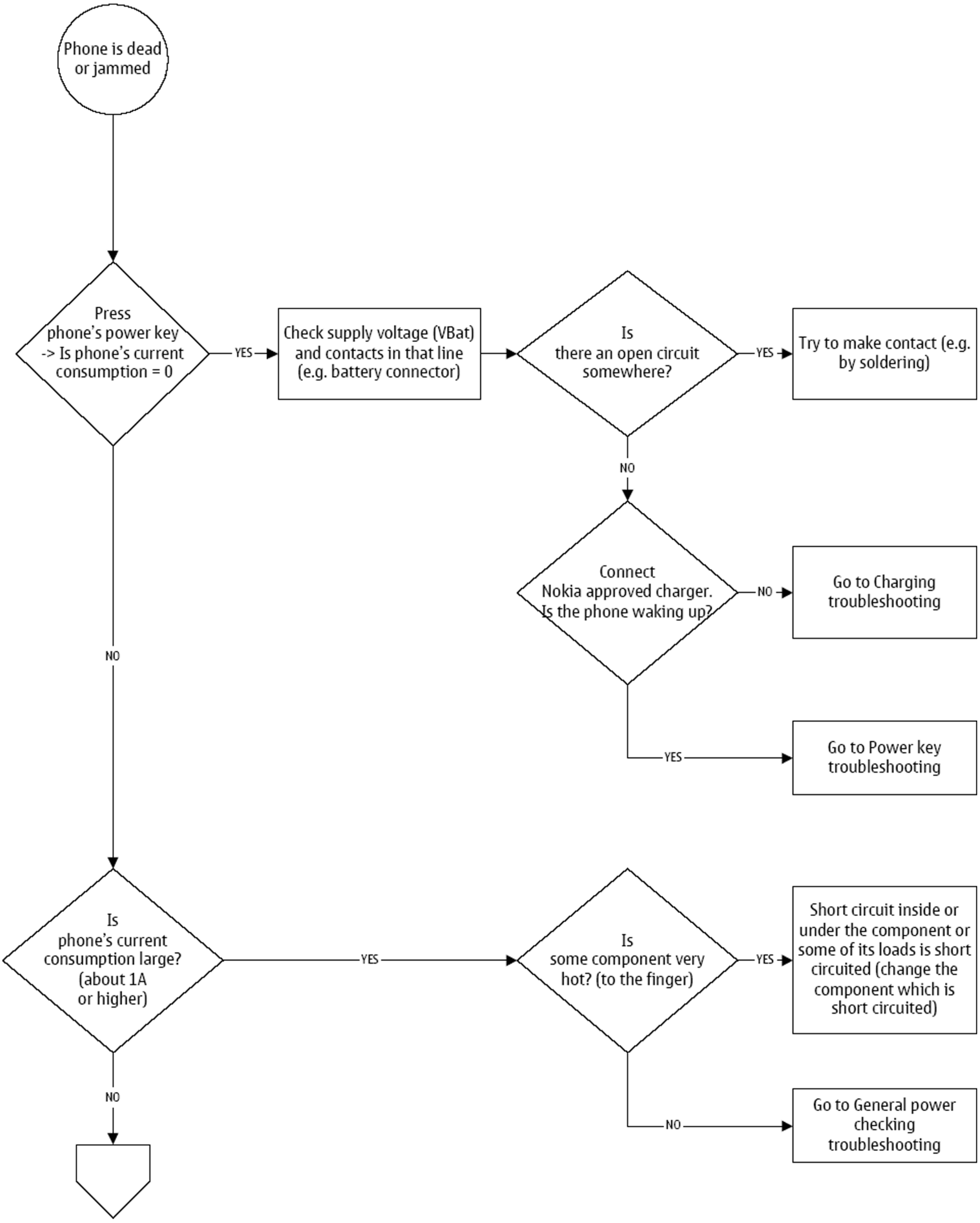
Troubleshooting flow


Start
Phone does not start up or is jammed
Abnormal current consumption
Dead or jammed device troubleshooting
Nothing happens when power key is pressed
Go to Power key troubleshooting
Something happens but phone does not wake up
Go to General power checking troubleshooting
Go to Battery current measuring fault troubleshooting
Normal current consumption
Attempt Phoenix connection
No phoenix connection To the phone
Flash the phone
Flashing fails
Go to Flash programming fault troubleshooting
Combo memory troubleshooting
Flashing succeeded
Phoenix connection works
Run selftests (Both in 'Test' mode and in 'Local' mode)
ST_PWR_KEY_TEST failures
Power consumption normal, no selftest failures
Display does not work
Something else than ST_PWR_KEY_TEST fails
ST_LCD_TEST fails
Go to Display Module troubleshooting
One or several of the following fails: ST_CURRENT_CONS_TEST ST_KEYBOARD_STUCK_TEST ST_SIM_CLK_LOOP_TEST ST_SIM_IO_CTRL_LOOP_TEST ST_SIM_LOCK_TEST ST_BACKUP_BATT_TEST ST_CAMERA_IF_TEST ST_SEC_CAMERA_IF_TEST ST_RADIO_TEST ST_BACKLIGHT_TEST ST_IRDA_LED_STRESS_TEST
Go to the respective troubleshooting: - General Power Checking Troubleshooting -Keypad troubleshooting - SIM card troubleshooting - General Power Checking (Check VBACK) - Camera module troubleshooting -FM radio troubleshooting - Display module (Backlight Troubleshooting) - Ignore IRDA_LED_STRESS result as phone does not have Infrared connection.
ST_LPRF_IF_TEST, ST_LPRF_AUDIO_LINES_TEST, ST_BT_WAKEUP_TEST, ST_BT_SLEEP_CLK_TEST fails or Bluetooth does not work
Go to Bluetooth troubleshooting
ST_EAR_DATA_LOOP_TEST failure / Audio(Mic/Earpiece/IHF) does not work
Go to Audio troubleshooting
ST_SLEEP_X_LOOP_TEST failure
SleepX or SleepClk line between D2800 (RAP) and N2300 (Betty) has failed
Go to power and charging troubleshooting
ST_UEM_CBUS_IF_TEST failure
ID reading from EM ASIC N2300 (Betty) and/or N2200 (Avilma) over CBUS has failed
Go to power and charging troubleshooting
ST_SLEEPCLK_FREQ_TEST failure
Sleepclk (SlClk of N2200) frequency not within limits 585.903-586.133
Change N2200 (Avilma)
ST_SECURITY_TEST failure
Try reflashing the phone.
Certificate restoring for BB5 products
Beyond economical repair
ST_BTEMP_TEST failure
Go to Charging Troubleshooting
ST_EXT_DEVICE_TEST failure
Go to Audio troubleshooting

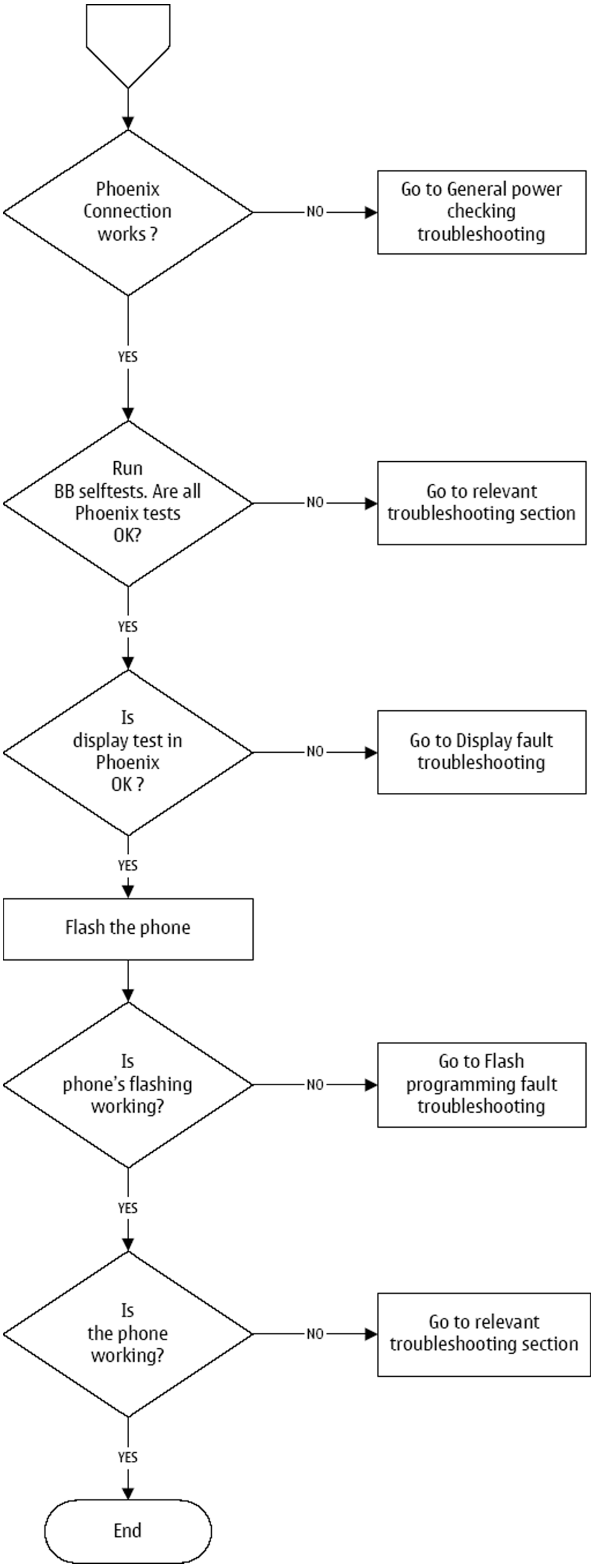
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check supply voltage (VBat) and contacts in that line (e.g. battery connector)
Is there an open circuit somewhere?
YES
Try to make contact (e.g. by soldering)
NO
Connect Nokia approved charger. Is the phone waking up?
NO
Go to Charging troubleshooting
YES
Go to Power key troubleshooting
NO
Is phone's current consumption large? (about 1A or higher)
YES
Is some component very hot? (to the finger)
YES
Short circuit inside or under the component or some of its loads is short circuited (change the component which is short circuited)
NO
Go to General power checking troubleshooting
NO

Troubleshooting flow


Phoenix Connection works ?
NO
Go to General power checking troubleshooting
YES
Run BB selftests. Are all Phoenix tests OK?
NO
Go to relevant troubleshooting section
YES
Is display test in Phoenix OK ?
NO
Go to Display fault troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to Flash programming fault troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
End

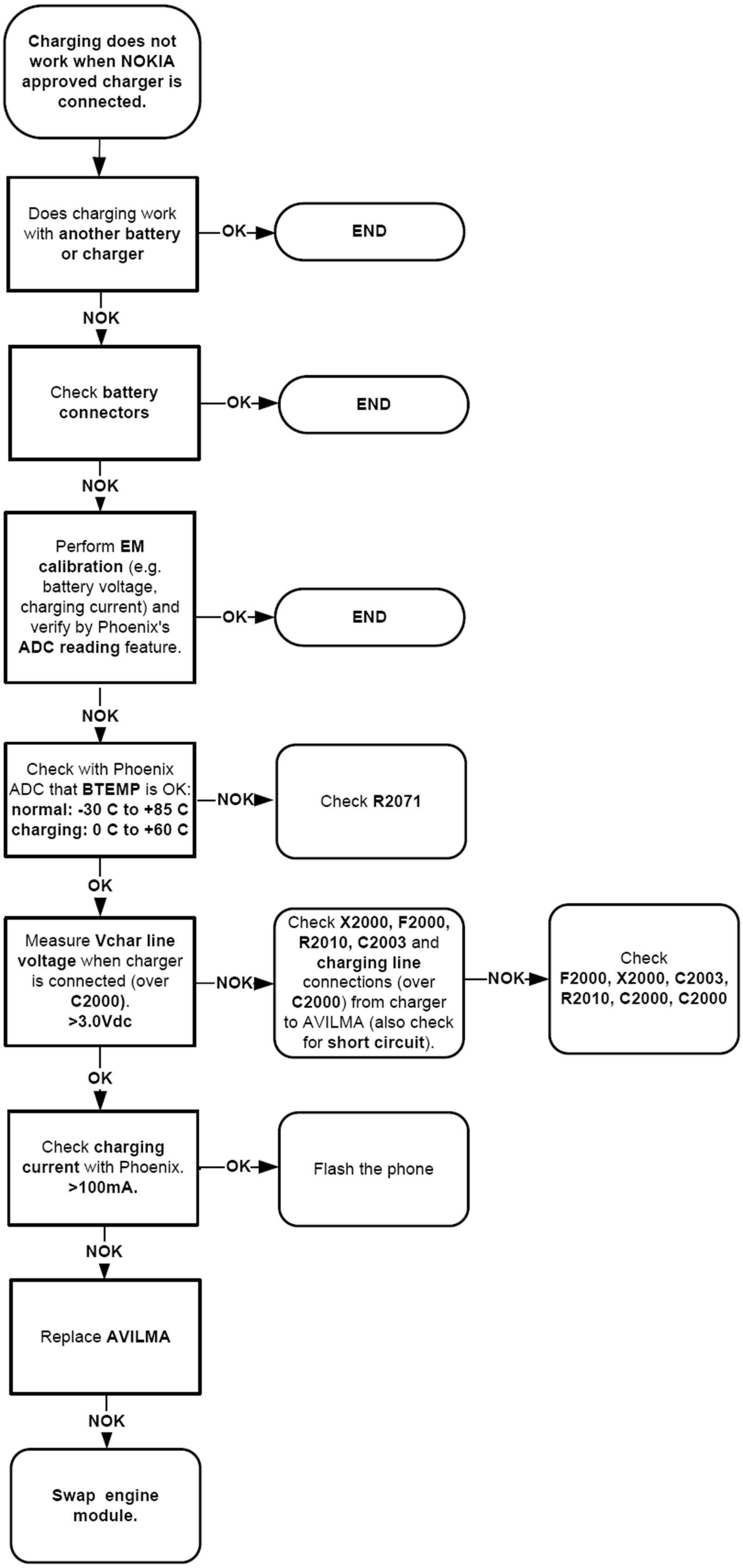
General power checking

Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	AVILMA	ON	ON	1.82	Memory, I/Os, Display	
VBACK	AVILMA	ON	ON	2.5	Back-up battery	
VSIM1	AVILMA	ON	ON	1.8/3.0	SIM card	
VDRAM	AVILMA	ON	ON	1.82	SDRAM	
VAUX	AVILMA	ON	ON	2.78	Camera, Display	
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators, RFIC	
VRFC	AVILMA	OFF	ON	1.8	RAPS	
VRCP1	AVILMA			4.75	To RF parts	RF active
VREF	AVILMA	ON	ON	1.35	RF reference	
VCORE	BETTY	ON	ON	1.05 1.25 1.35 1.40	RAPS digital	
VOUT	BETTY	OFF	OFF	2.5		Accessory connected
VMMC	KMBGN000A/ N3200	OFF	OFF	2.850	Internal memory	Disabled in sleep
VLED_POS	TPS61061/ N2301	OFF	OFF	14.5	LCD Backlight	Disabled in sleep

Charging troubleshooting

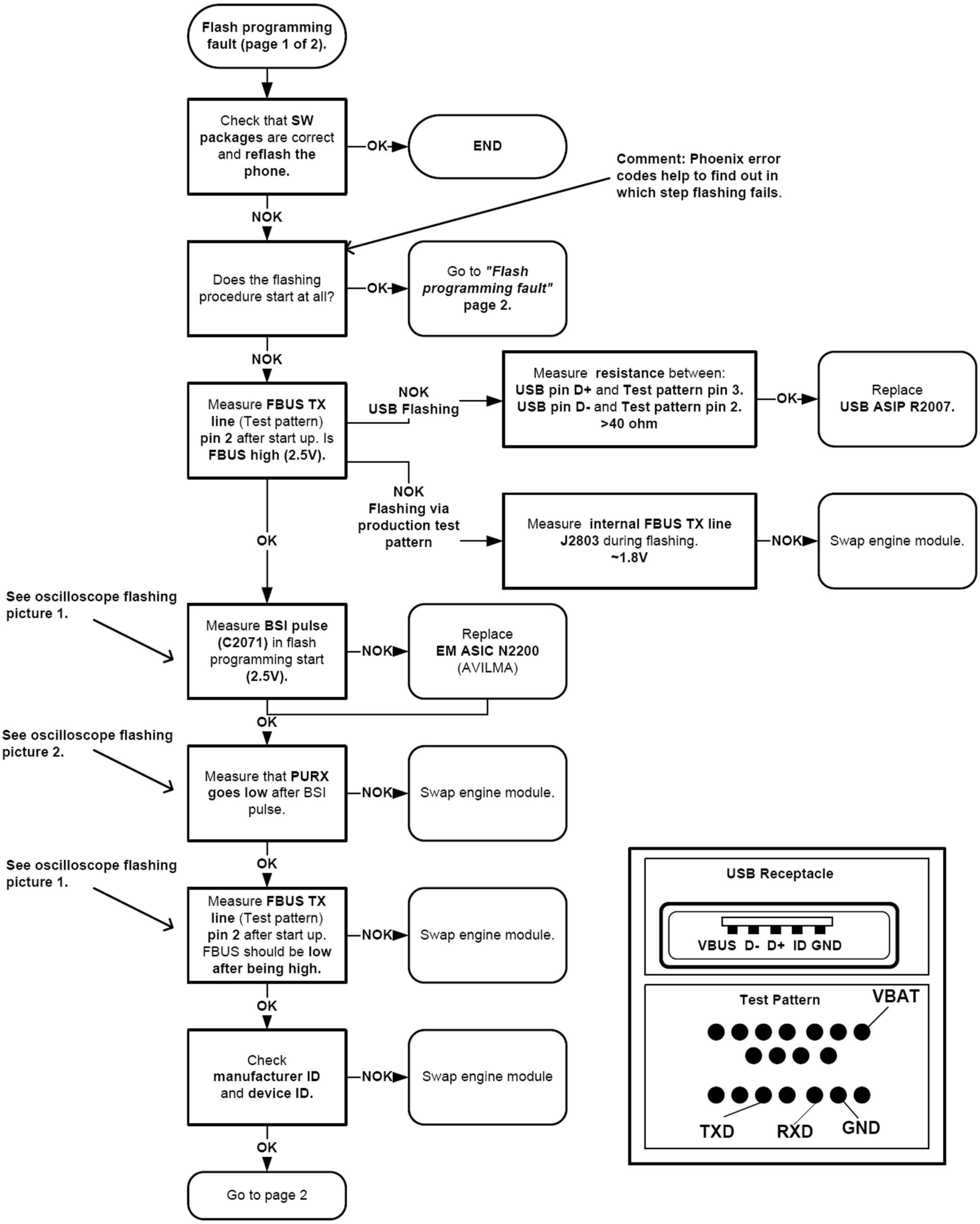
Troubleshooting flow


Charging does not work when NOKIA approved charger is connected.
Does charging work with another battery or charger
OK
END
NOK
Check battery connectors
OK
END
NOK
Perform EM calibration (e.g. battery voltage, charging current) and verify by Phoenix's ADC reading feature.
OK
END
NOK
Check with Phoenix ADC that BTEMP is OK: normal: -30 C to +85 C charging: 0 C to +60 C
NOK
Check R2071
OK
Measure Vchar line voltage when charger is connected (over C2000). >3.0Vdc
NOK
Check X2000, F2000, R2010, C2003 and charging line connections (over C2000) from charger to AVILMA (also check for short circuit).
NOK
Check F2000, X2000, C2003, R2010, C2000, C2000
OK
Check charging current with Phoenix. >100mA.
OK
Flash the phone
NOK
Replace AVILMA
NOK
Swap engine module.

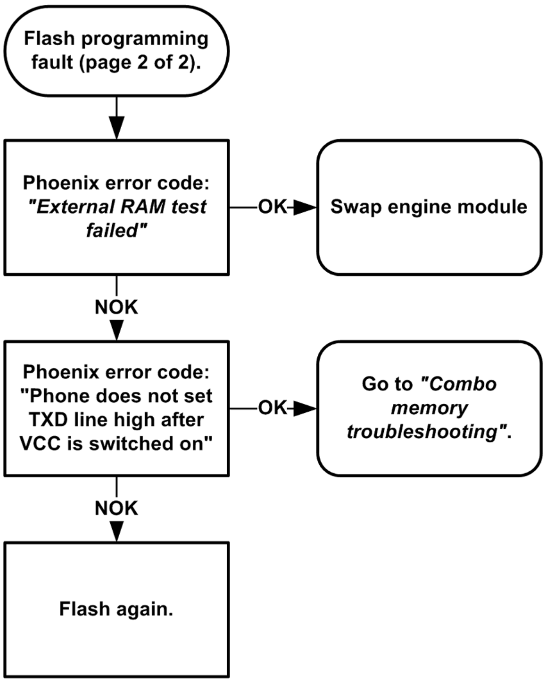
Interface troubleshooting

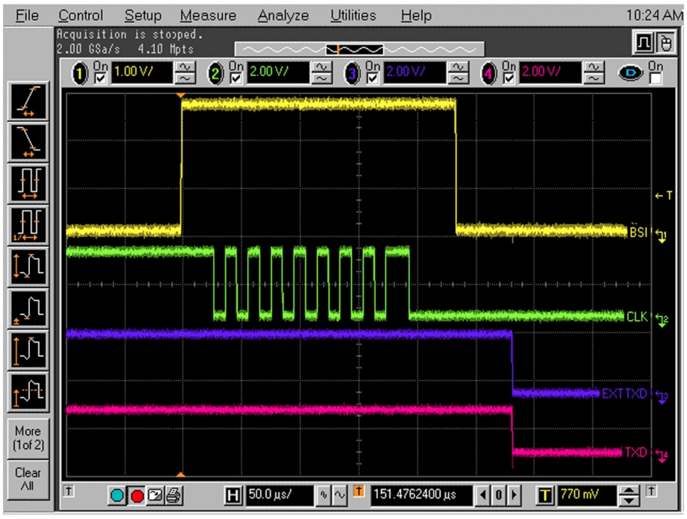
Flash programming fault troubleshooting

Part 1


Flash programming fault (page 1 of 2).
Check that SW packages are correct and reflash the phone.
OK
END
Comment: Phoenix error codes help to find out in which step flashing fails.
NOK
Does the flashing procedure start at all?
OK
Go to "Flash programming fault" page 2.
NOK
Measure FBUS TX line (Test pattern) pin 2 after start up. Is FBUS high (2.5V).
NOK
USB Flashing
Measure resistance between: USB pin D+ and Test pattern pin 3. USB pin D- and Test pattern pin 2. >40 ohm
OK
Replace USB ASIP R2007.
NOK
Flashing via production test pattern
Measure internal FBUS TX line J2803 during flashing. ~1.8V
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure BSI pulse (C2071) in flash programming start (2.5V).
NOK
Replace EM ASIC N2200 (AVILMA)
OK
See oscilloscope flashing picture 2.
Measure that PURX goes low after BSI pulse.
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure FBUS TX line (Test pattern) pin 2 after start up. FBUS should be low after being high.
NOK
Swap engine module.
OK
Check manufacturer ID and device ID.
NOK
Swap engine module
OK
Go to page 2
USB Receptacle
VBUS D- D+ ID GND
Test Pattern
VBAT
TXD
RXD
GND

Part 2


Flash programming fault (page 2 of 2).
Phoenix error code: *"External RAM test failed"*
OK
Swap engine module
NOK
Phoenix error code: "Phone does not set TXD line high after VCC is switched on"
OK
Go to *"Combo memory troubleshooting"*.
NOK
Flash again.



```
Acquisition is stopped.
2.00 GSa/s   4.10 Mpts
```

File
Control
Setup
Measure
Analyze
Utilities
Help
10:24 AM
1 On 1.00 V/
2 On 2.00 V/
3 On 2.00 V/
4 On 2.00 V/
On
BSI
CLK
EXTTXD
TXD
More (1of 2)
Clear All
H 50.0 µs/
T 151.4762400 µs
0
T 770 mV

Figure 10 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

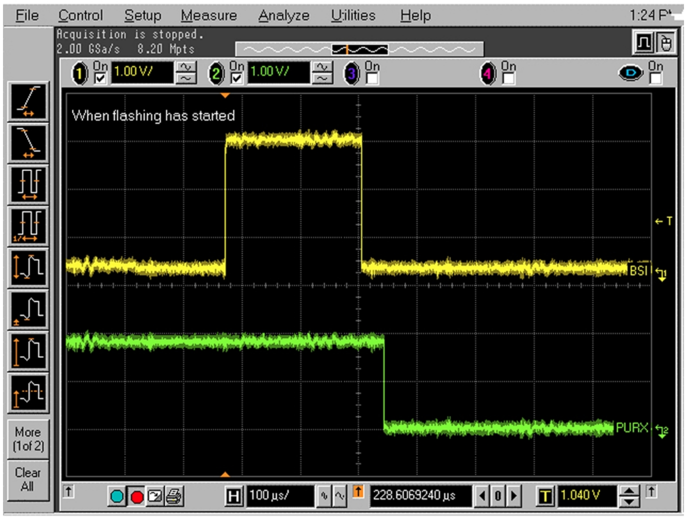
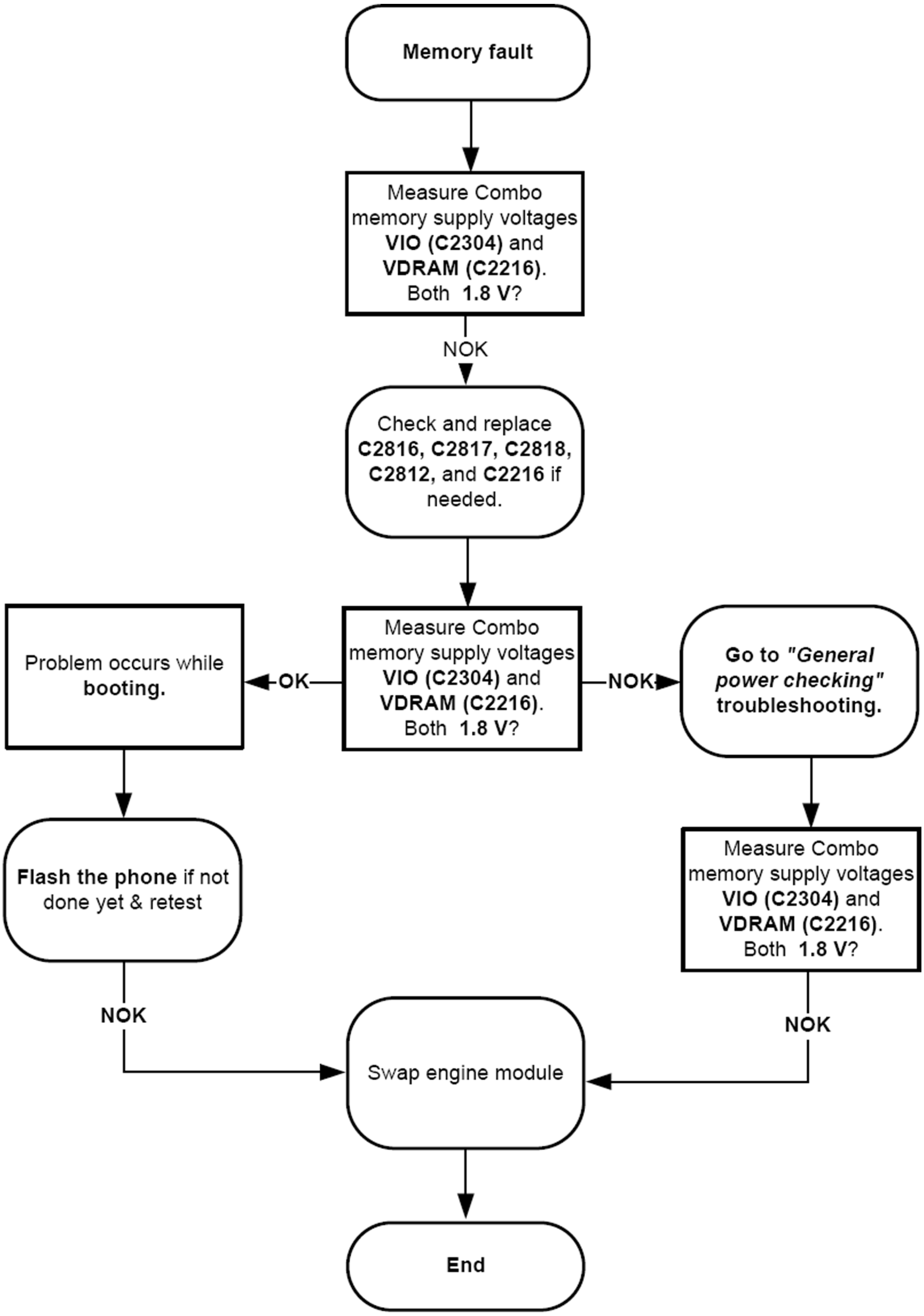

File
Control
Setup
Measure
Analyze
Utilities
Help
1:24 PM
Acquisition is stopped.
2.00 GSa/s 8.20 Mpts
1.00 V/
1.00 V/
On
More (1 of 2)
Clear All
When flashing has started
T
BSI
PURX
100 µs/
228.6069240 µs
1.040 V

Figure 11 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

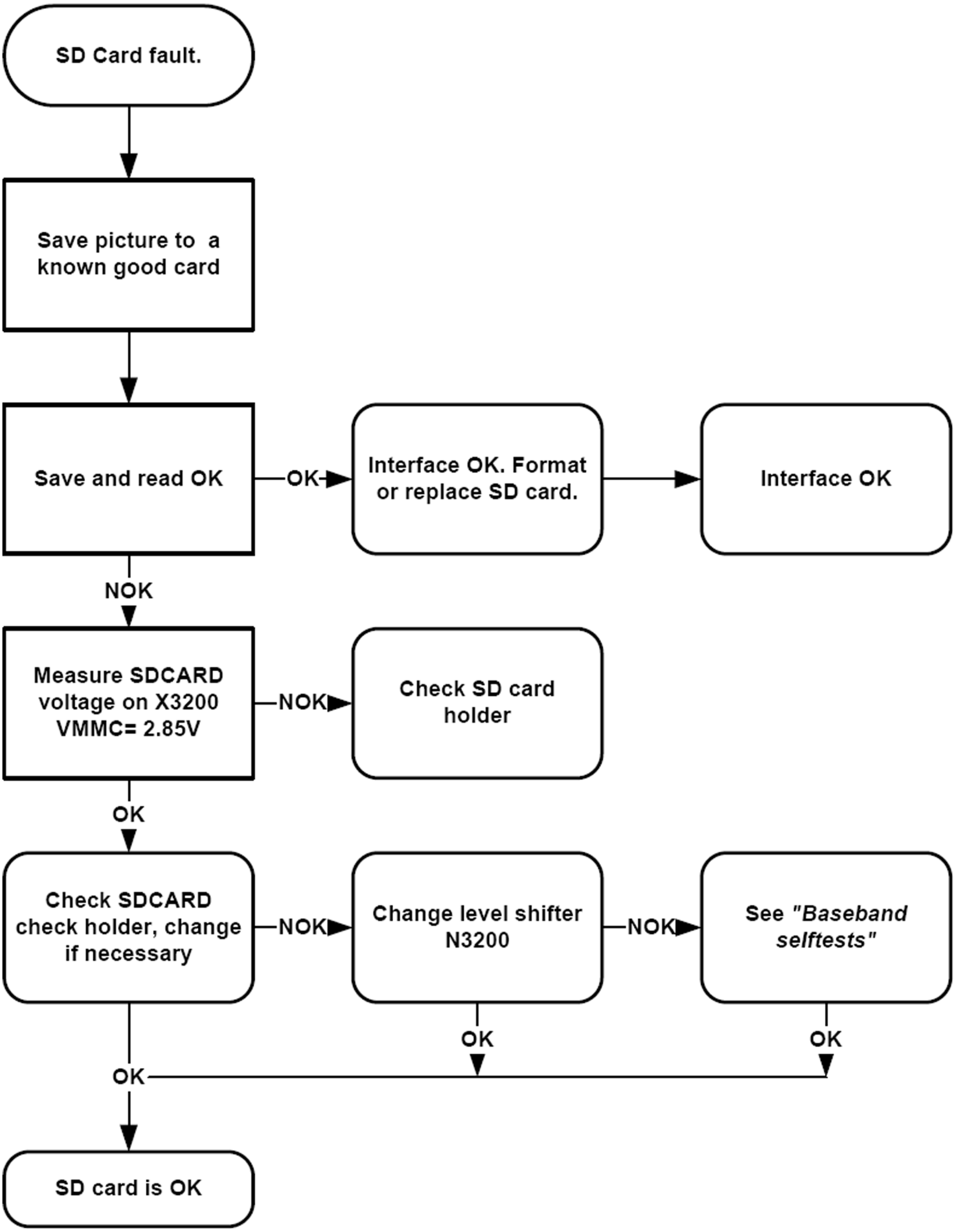
Combo memory troubleshooting

Troubleshooting flow


Memory fault
Measure Combo memory supply voltages **VIO (C2304)** and **VDRAM (C2216)**. Both **1.8 V**?
NOK
Check and replace **C2816, C2817, C2818, C2812**, and **C2216** if needed.
Measure Combo memory supply voltages **VIO (C2304)** and **VDRAM (C2216)**. Both **1.8 V**?
OK
Problem occurs while **booting.**
NOK
Go to *"General power checking"* troubleshooting.
Flash the phone if not done yet & retest
Measure Combo memory supply voltages **VIO (C2304)** and **VDRAM (C2216)**. Both **1.8 V**?
NOK
NOK
Swap engine module
End

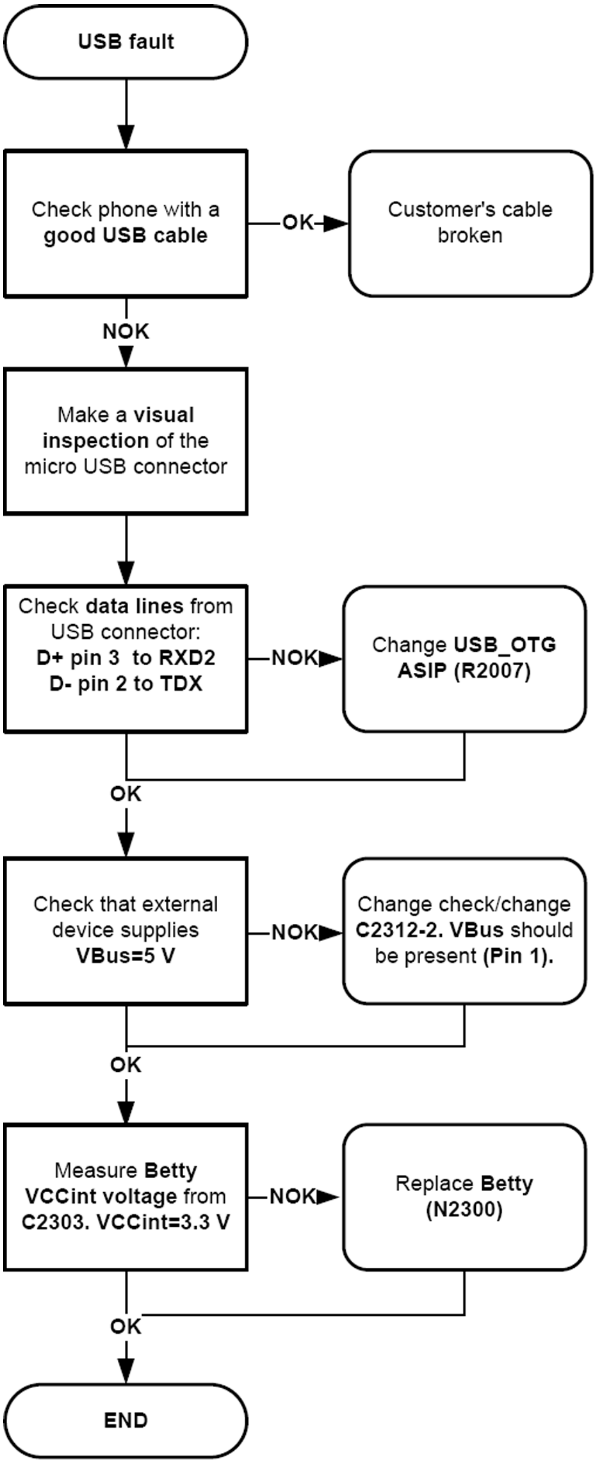
SD card troubleshooting

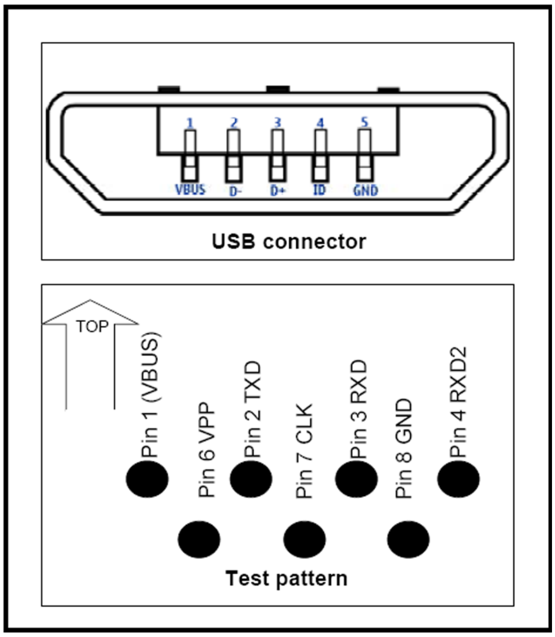
Troubleshooting flow


SD Card fault.
Save picture to a known good card
Save and read OK
OK
Interface OK. Format or replace SD card.
Interface OK
NOK
Measure SDCARD voltage on X3200 VMMC= 2.85V
NOK
Check SD card holder
OK
Check SDCARD check holder, change if necessary
NOK
Change level shifter N3200
NOK
See *"Baseband selftests"*
OK
OK
OK
SD card is OK

USB interface troubleshooting

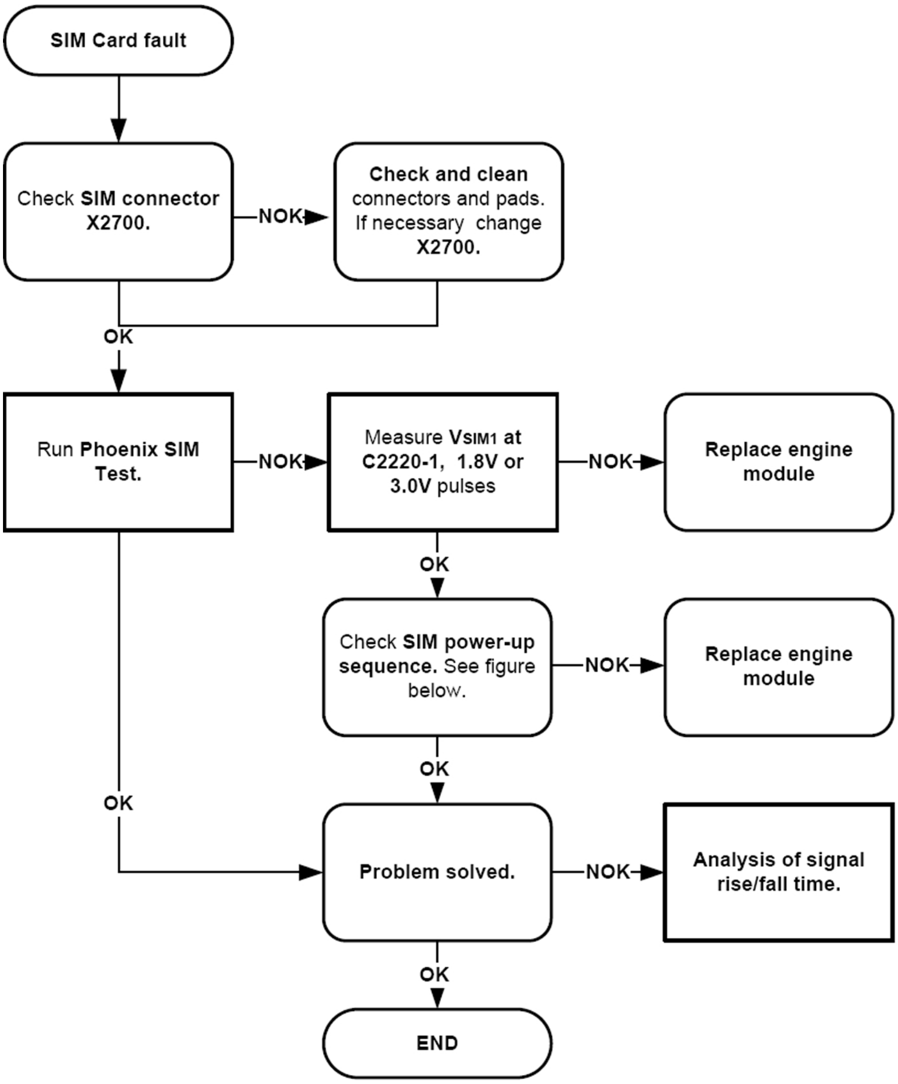
Troubleshooting flow

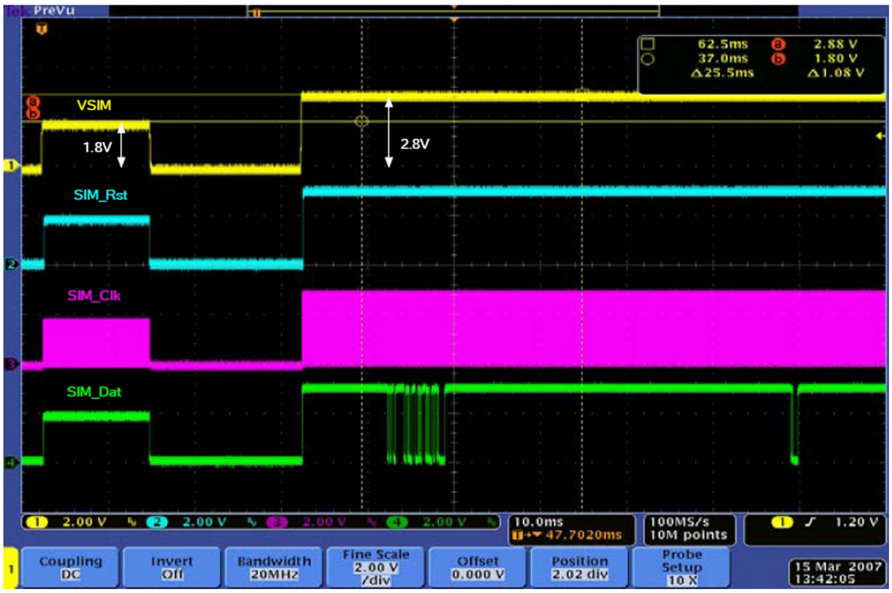

USB fault
Check phone with a good USB cable
OK
Customer's cable broken
NOK
Make a visual inspection of the micro USB connector
Check data lines from USB connector: D+ pin 3 to RXD2 D- pin 2 to TDX
NOK
Change USB_OTG ASIP (R2007)
OK
Check that external device supplies VBus=5 V
NOK
Change check/change C2312-2. VBus should be present (Pin 1).
OK
Measure Betty VCCint voltage from C2303. VCCint=3.3 V
NOK
Replace Betty (N2300)
OK
END


1
2
3
4
5
VBUS
D-
D+
ID
GND
USB connector
TOP
Pin 1 (VBUS)
Pin 6 VPP
Pin 2 TXD
Pin 7 CLK
Pin 3 RXD
Pin 8 GND
Pin 4 RXD2
Test pattern

SIM card troubleshooting

Troubleshooting flow


SIM Card fault
Check SIM connector X2700.
NOK
Check and clean connectors and pads. If necessary change X2700.
OK
Run Phoenix SIM Test.
NOK
Measure VSIM1 at C2220-1, 1.8V or 3.0V pulses
NOK
Replace engine module
OK
Check SIM power-up sequence. See figure below.
NOK
Replace engine module
OK
OK
Problem solved.
NOK
Analysis of signal rise/fall time.
OK
END


PreVu
62.5ms 2.88 V
37.0ms 1.80 V
Δ25.5ms Δ1.08 V
VSIM
1.8V
2.8V
SIM_Rst
SIM_Clk
SIM_Dat
2.00 V
2.00 V
2.00 V
2.00 V
10.0ms
47.7020ms
100MS/s
10M points
1.20 V
Coupling DC
Invert Off
Bandwidth 20MHz
Fine Scale 2.00 V /div
Offset 0.000 V
Position 2.02 div
Probe Setup 10 X
15 Mar 2007
13:42:05

User interface troubleshooting

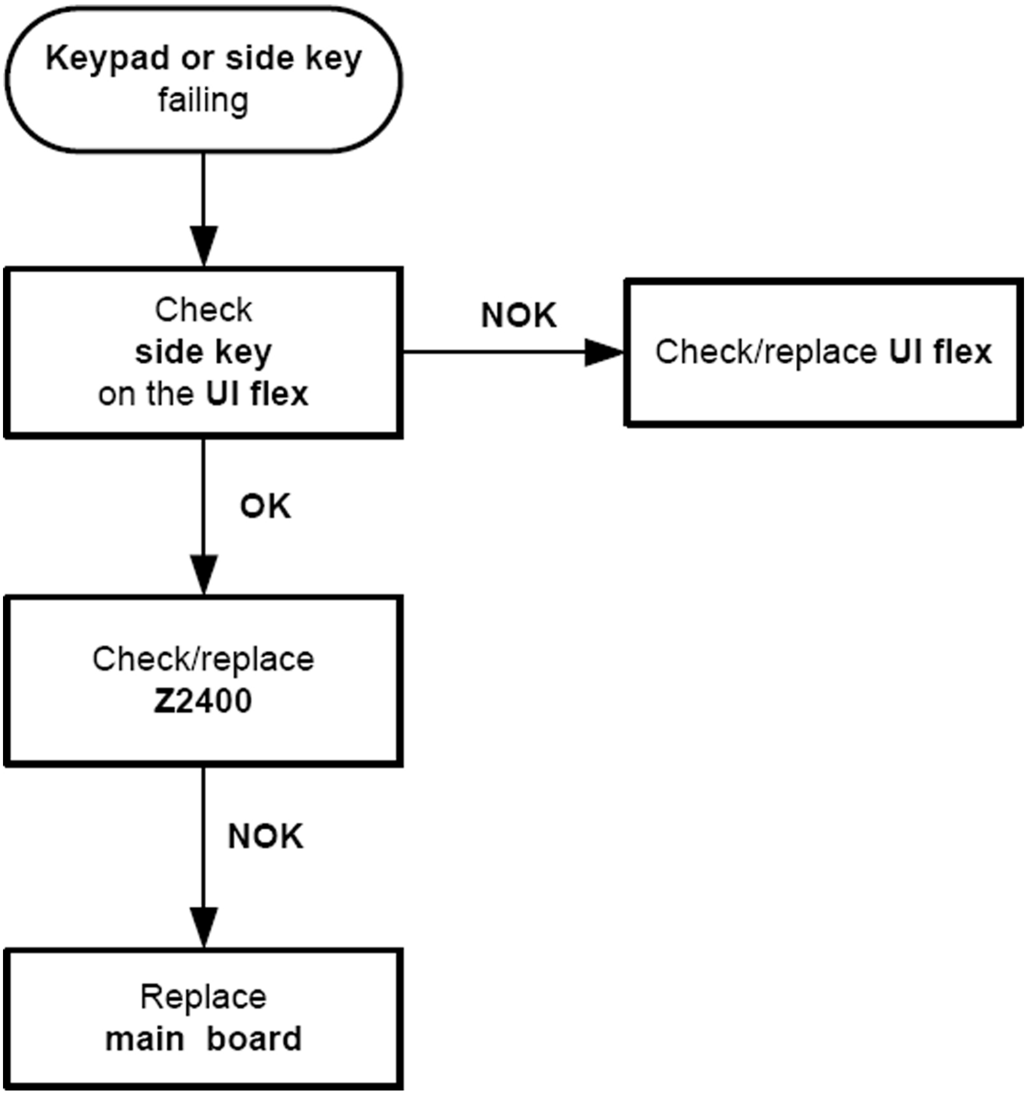
Keypad and side key troubleshooting

Context

If one or more keys are stuck, so that the key does not react when a keydome or the side key is pressed, the failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)

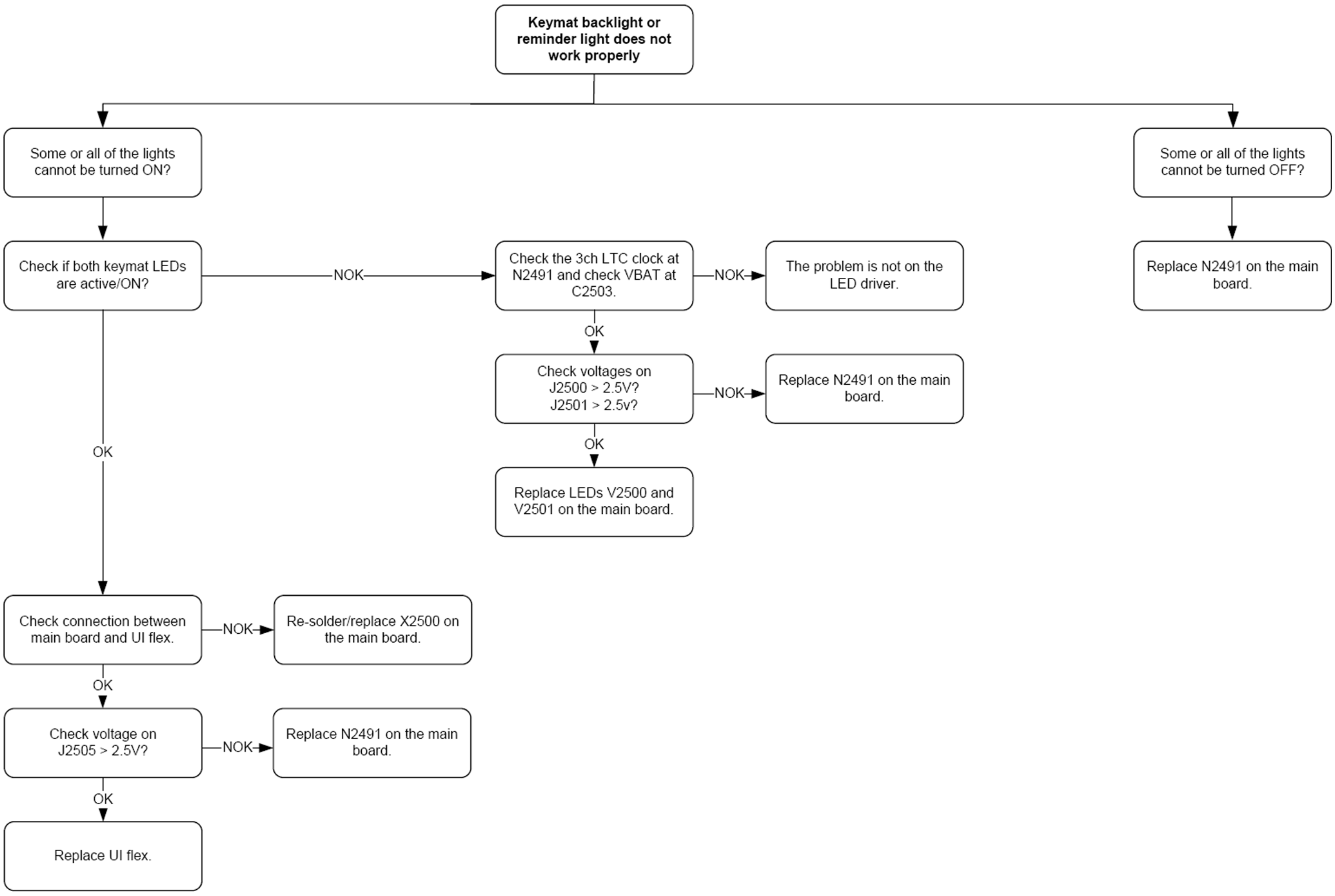
If the failure mode is not clear, start with the Keyboard test in Phoenix.

Troubleshooting flow


Keypad or side key failing
Check side key on the UI flex
NOK
Check/replace UI flex
OK
Check/replace Z2400
NOK
Replace main board

Keymat backlight and reminder light troubleshooting

Troubleshooting flow


Keymat backlight or reminder light does not work properly
Some or all of the lights cannot be turned ON?
Some or all of the lights cannot be turned OFF?
Check if both keymat LEDs are active/ON?
NOK
Check the 3ch LTC clock at N2491 and check VBAT at C2503.
NOK
The problem is not on the LED driver.
Replace N2491 on the main board.
OK
Check voltages on J2500 > 2.5V? J2501 > 2.5v?
NOK
Replace N2491 on the main board.
OK
Replace LEDs V2500 and V2501 on the main board.
OK
Check connection between main board and UI flex.
NOK
Re-solder/replace X2500 on the main board.
OK
Check voltage on J2505 > 2.5V?
NOK
Replace N2491 on the main board.
OK
Replace UI flex.

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a sleep mode when the phone is in the screen saver mode.

Table 8 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.

Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 9 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.

2. Check that the cellular engine is working normally.
   - i To check the functionality, connect the phone to a docking station.
   - ii Start *Phoenix* service software.
   - iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

3. Proceed to the display troubleshooting flowcharts.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display module troubleshooting

Context

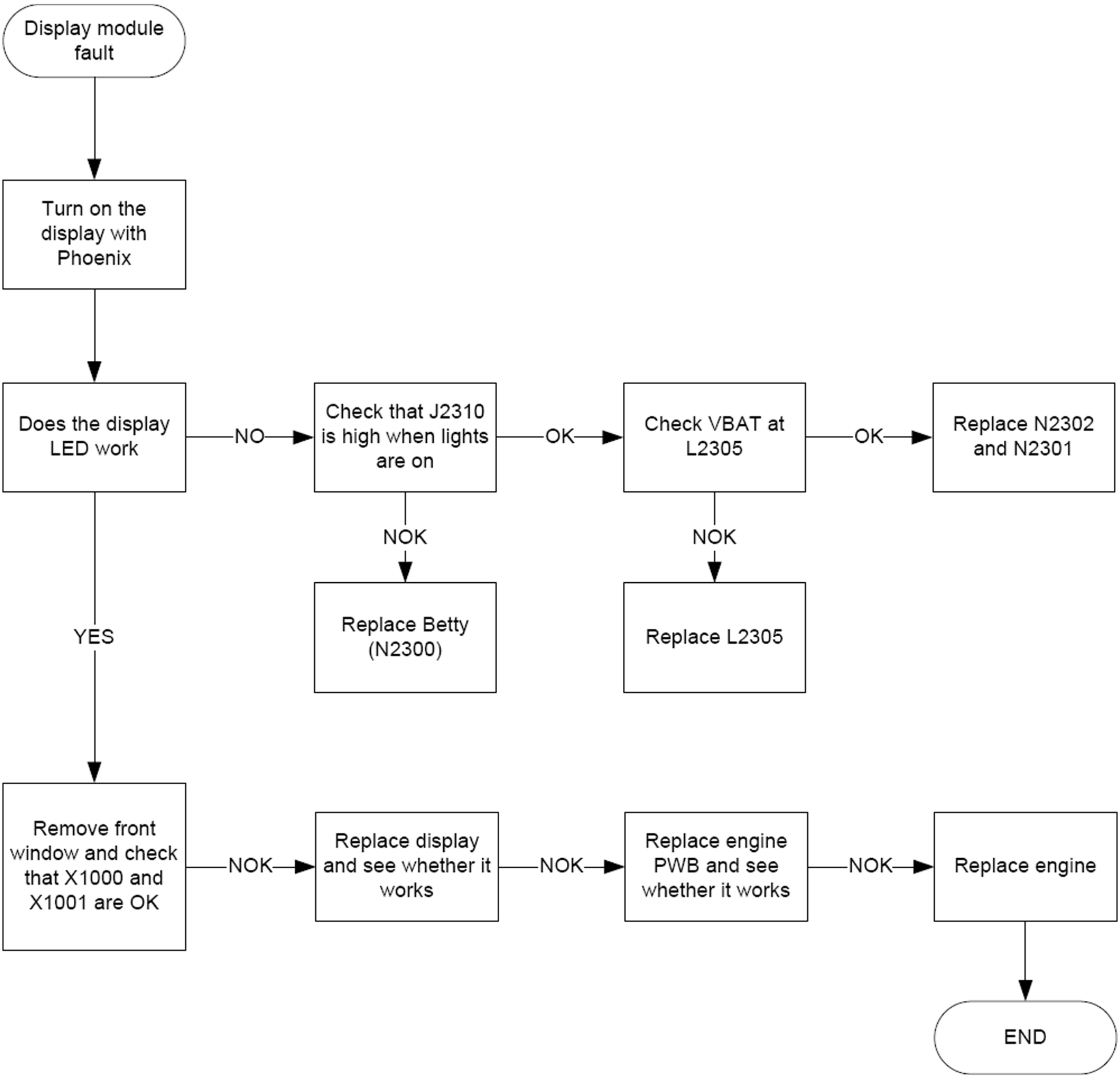
The display module consists of two different displays, a main display and a secondary display. The state of the displays is determined by the state of the phone.

Fold	Main display	Secondary display
Open	On	Off

Fold	Main display	Secondary display
Closed	Off	On

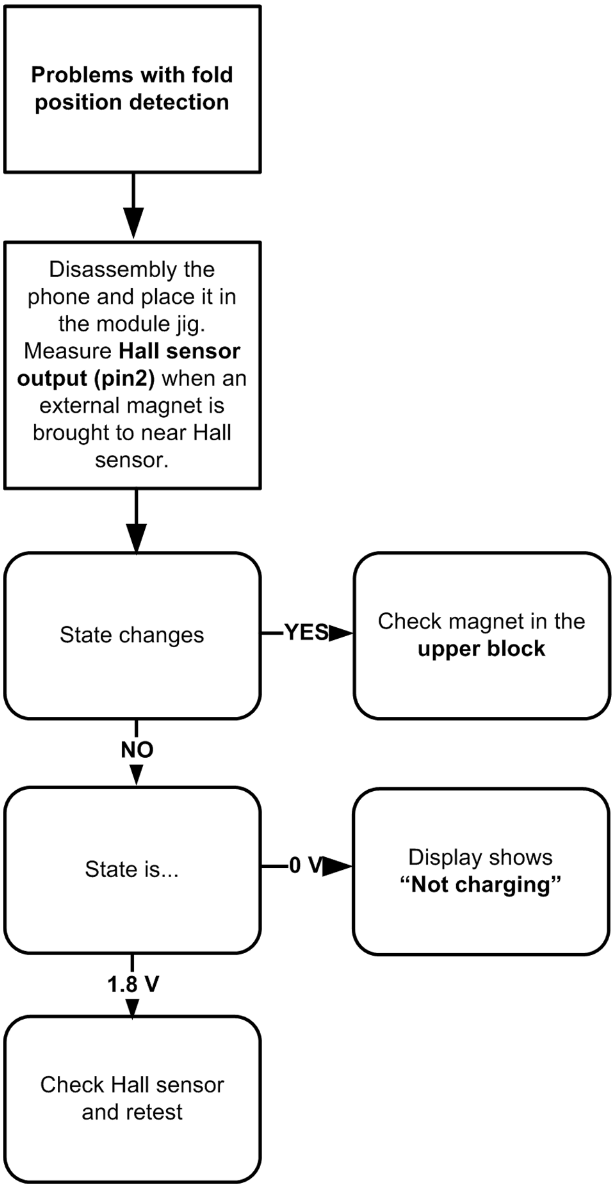
Use the display test tool in Phoenix to find the detailed fault mode.

Troubleshooting flow


Display module fault
Turn on the display with Phoenix
Does the display LED work
NO
Check that J2310 is high when lights are on
OK
Check VBAT at L2305
OK
Replace N2302 and N2301
NOK
Replace Betty (N2300)
NOK
Replace L2305
YES
Remove front window and check that X1000 and X1001 are OK
NOK
Replace display and see whether it works
NOK
Replace engine PWB and see whether it works
NOK
Replace engine
END

Hall sensor (switch) troubleshooting

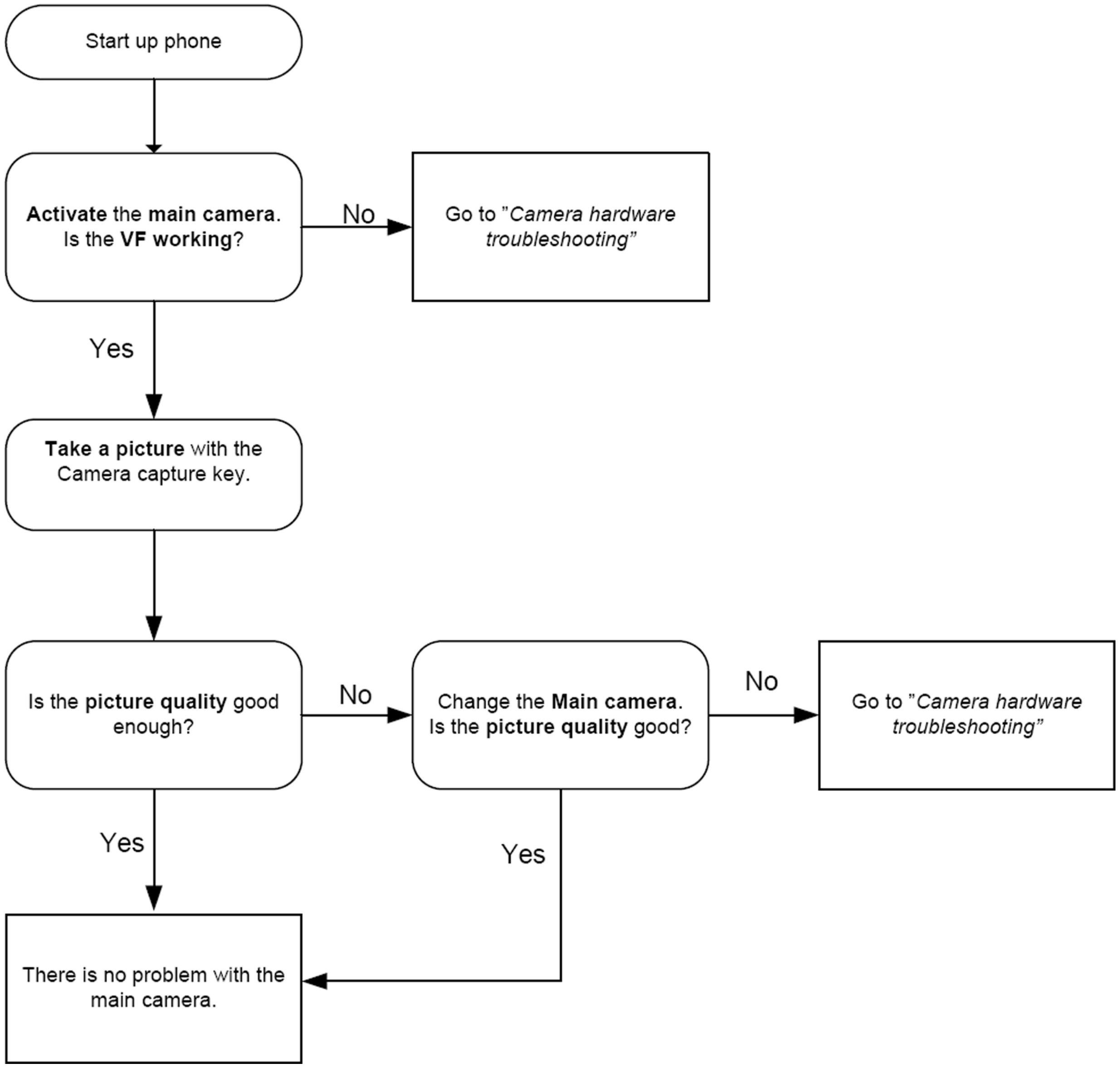
Troubleshooting flow


Problems with fold position detection
Disassembly the phone and place it in the module jig. Measure Hall sensor output (pin2) when an external magnet is brought to near Hall sensor.
State changes
YES
Check magnet in the upper block
NO
State is...
0 V
Display shows "Not charging"
1.8 V
Check Hall sensor and retest

Camera troubleshooting

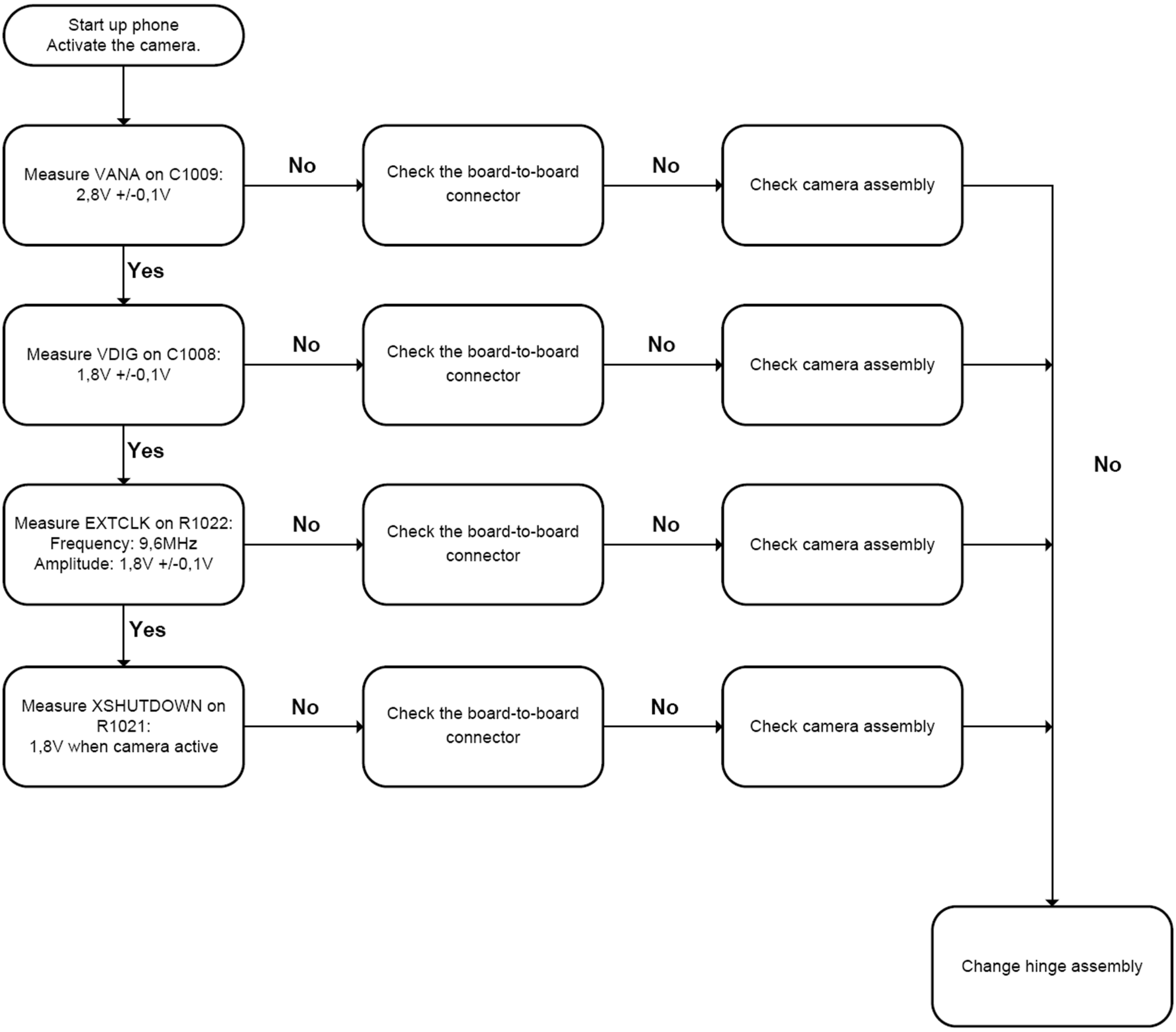
Camera troubleshooting

Troubleshooting flow


Start up phone
Activate the main camera. Is the VF working?
No
Go to "Camera hardware troubleshooting"
Yes
Take a picture with the Camera capture key.
Is the picture quality good enough?
No
Change the Main camera. Is the picture quality good?
No
Go to "Camera hardware troubleshooting"
Yes
Yes
There is no problem with the main camera.

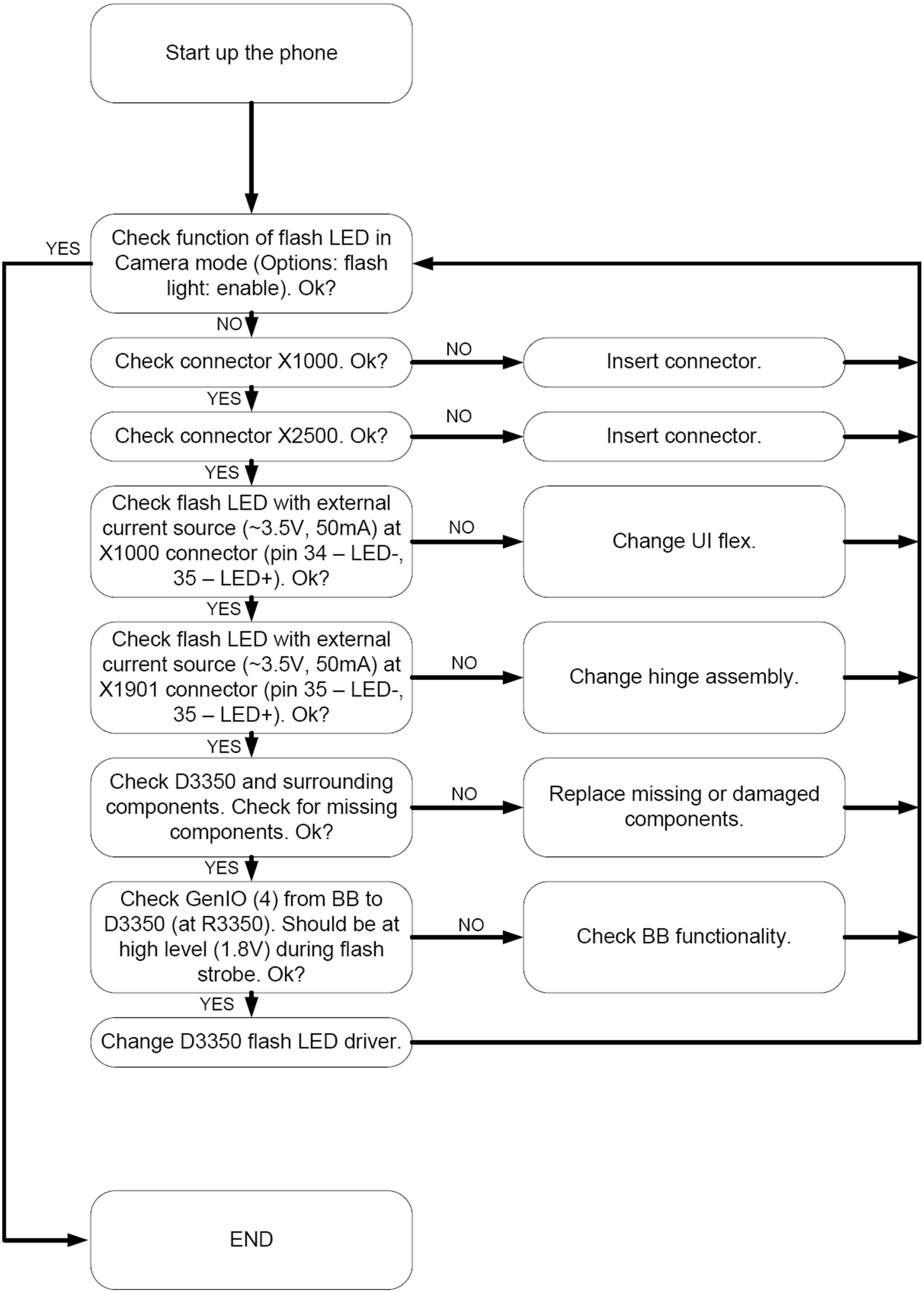
Camera hardware troubleshooting

Troubleshooting flow


Start up phone
Activate the camera.
Measure VANA on C1009: 2,8V +/-0,1V
No
Check the board-to-board connector
No
Check camera assembly
Yes
Measure VDIG on C1008: 1,8V +/-0,1V
No
Check the board-to-board connector
No
Check camera assembly
Yes
Measure EXTCLK on R1022: Frequency: 9,6MHz Amplitude: 1,8V +/-0,1V
No
Check the board-to-board connector
No
Check camera assembly
Yes
Measure XSHUTDOWN on R1021: 1,8V when camera active
No
Check the board-to-board connector
No
Check camera assembly
No
Change hinge assembly

Camera flash LED troubleshooting

Troubleshooting flow


Start up the phone
Check function of flash LED in Camera mode (Options: flash light: enable). Ok?
YES
NO
Check connector X1000. Ok?
NO
Insert connector.
YES
Check connector X2500. Ok?
NO
Insert connector.
YES
Check flash LED with external current source (~3.5V, 50mA) at X1000 connector (pin 34 – LED-, 35 – LED+). Ok?
NO
Change UI flex.
YES
Check flash LED with external current source (~3.5V, 50mA) at X1901 connector (pin 35 – LED-, 35 – LED+). Ok?
NO
Change hinge assembly.
YES
Check D3350 and surrounding components. Check for missing components. Ok?
NO
Replace missing or damaged components.
YES
Check GenIO (4) from BB to D3350 (at R3350). Should be at high level (1.8V) during flash strobe. Ok?
NO
Check BB functionality.
YES
Change D3350 flash LED driver.
END

Audio troubleshooting

Audio troubleshooting test instructions

Single-ended external earpiece and differential internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential. Exception to this is a digital microphone, which needs input signal from an external sound source (laptop speaker) to playback eg. 1kHz sine wave from 5cm distance.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V
- Sound source (laptop speaker or B&K type 4231 calibrator)

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Digital stereo microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	HS_MIC & GND	HS_EAR_L & GND	12	140	1.9Vpp	1.2	NA
		HS_EAR_R & GND					
External Mic to Internal Earpiece	HS_MIC & GND	EarP & GND	0	100	100	1.2	NA
		EarN & GND					
External Mic to Internal handsfree	HS_MIC & GND	J2103 & J2104	6	200	500		
		J2101 & J2102					
Digital Mic to External Earpiece	Acoustical input, 1kHz sine wave	HS_EAR_L & GND	NA	94 dB SPL	100		NA
		HS_EAR_R & GND					

Measurement data

Earpiece signal

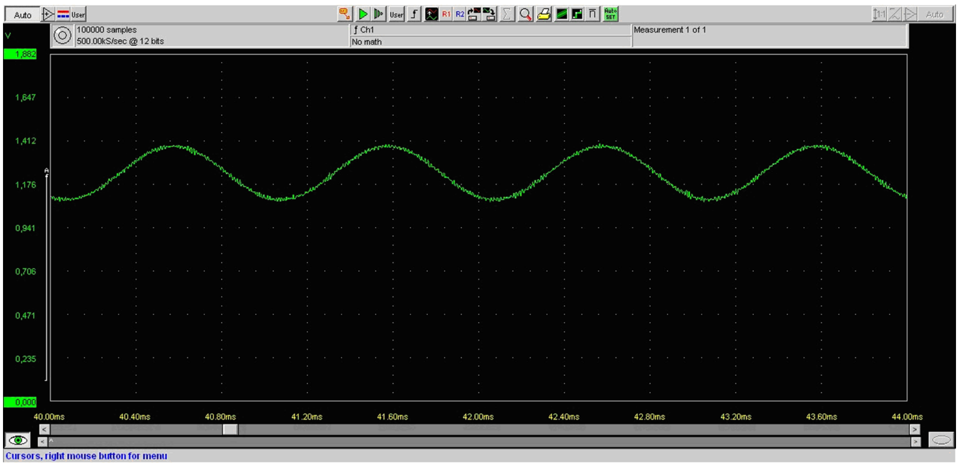
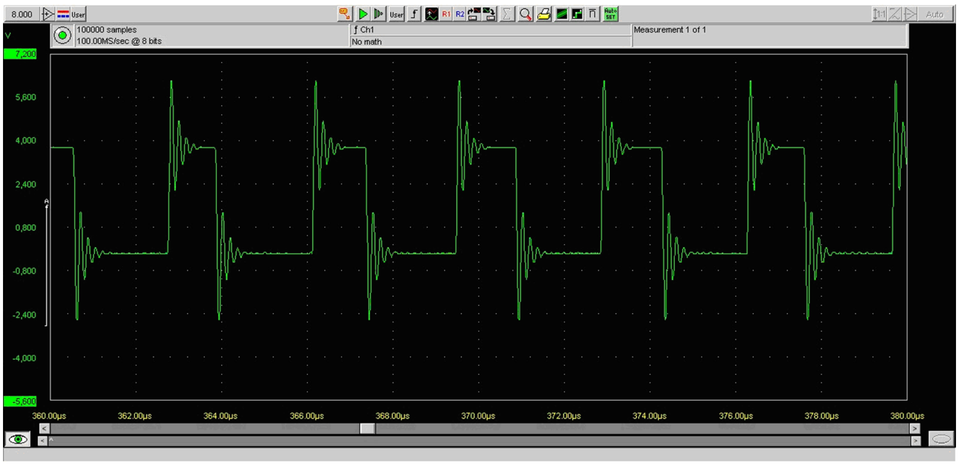

Auto
User
User
R1
R2
Auto SET
Auto
100000 samples
500.00kS/sec @ 12 bits
ƒ Ch1
No math
Measurement 1 of 1
V
1,882
1,647
1,412
1,176
0,941
0,706
0,471
0,235
0,000
40.00ms
40.40ms
40.80ms
41.20ms
41.60ms
42.00ms
42.40ms
42.80ms
43.20ms
43.60ms
44.00ms
Cursors, right mouse button for menu

Figure 12 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.

Integrated handsfree signal

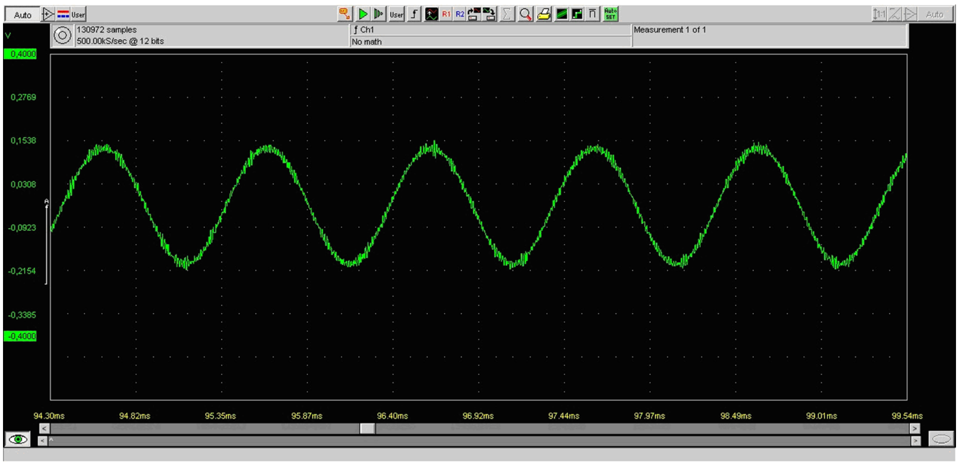


100000 samples
100.00MS/sec @ 8 bits
ƒ Ch1
No math
Measurement 1 of 1

8.000
User
V
7,200
5,600
4,000
2,400
0,800
-0,800
-2,400
-4,000
-5,600
360.00µs
362.00µs
364.00µs
366.00µs
368.00µs
370.00µs
372.00µs
374.00µs
376.00µs
378.00µs
380.00µs
Auto

Figure 13 Single-ended output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected (measured at speaker pads). No filter is used.

External output from AV

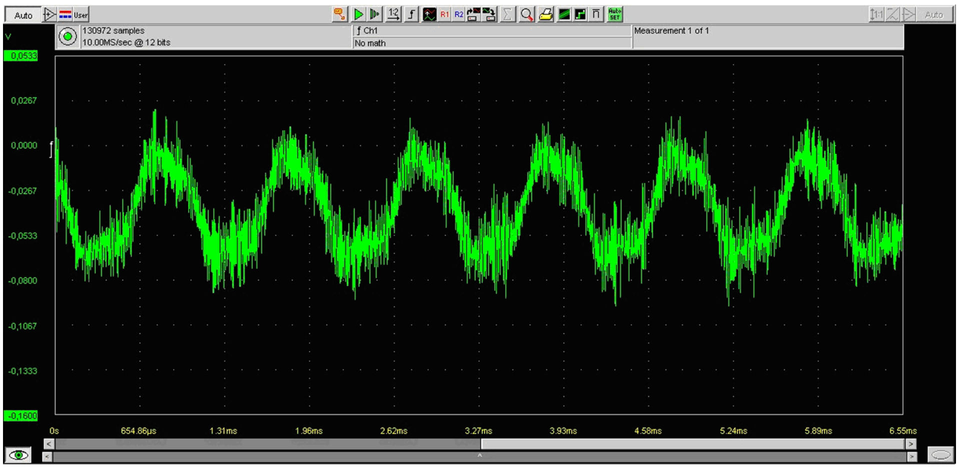


130972 samples
500.00kS/sec @ 12 bits
ƒ Ch1
No math
Measurement 1 of 1

Auto
User
V
0,4000
0,2769
0,1538
0,0308
-0,0923
-0,2154
-0,3385
-0,4000
94.30ms
94.82ms
95.35ms
95.87ms
96.40ms
96.92ms
97.44ms
97.97ms
98.49ms
99.01ms
99.54ms
Auto

Figure 14 Single-ended output waveform of the Ext_in_Ext_out loop.

External output from AV (acoustic input)



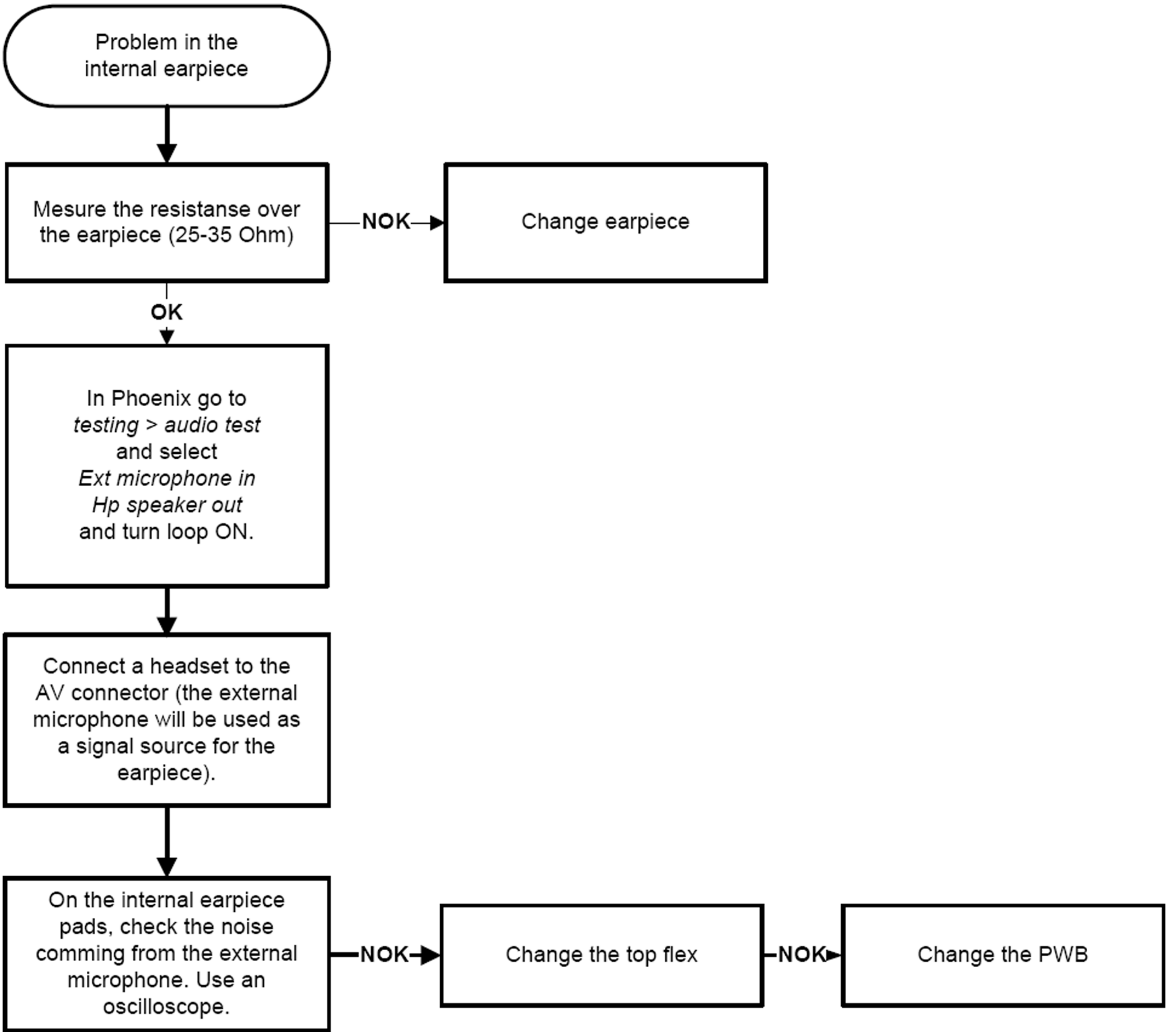
130972 samples
10.00MS/sec @ 12 bits
ƒ Ch1
No math
Measurement 1 of 1

Auto
User
V
0,0533
0,0267
0,0000
-0,0267
-0,0533
-0,0800
-0,1067
-0,1333
-0,1600
0s
654.86µs
1.31ms
1.96ms
2.62ms
3.27ms
3.93ms
4.58ms
5.24ms
5.89ms
6.55ms
Auto

Figure 15 Single-ended output waveform of the Digital_stereo_microphone_in_Ext_out loop.

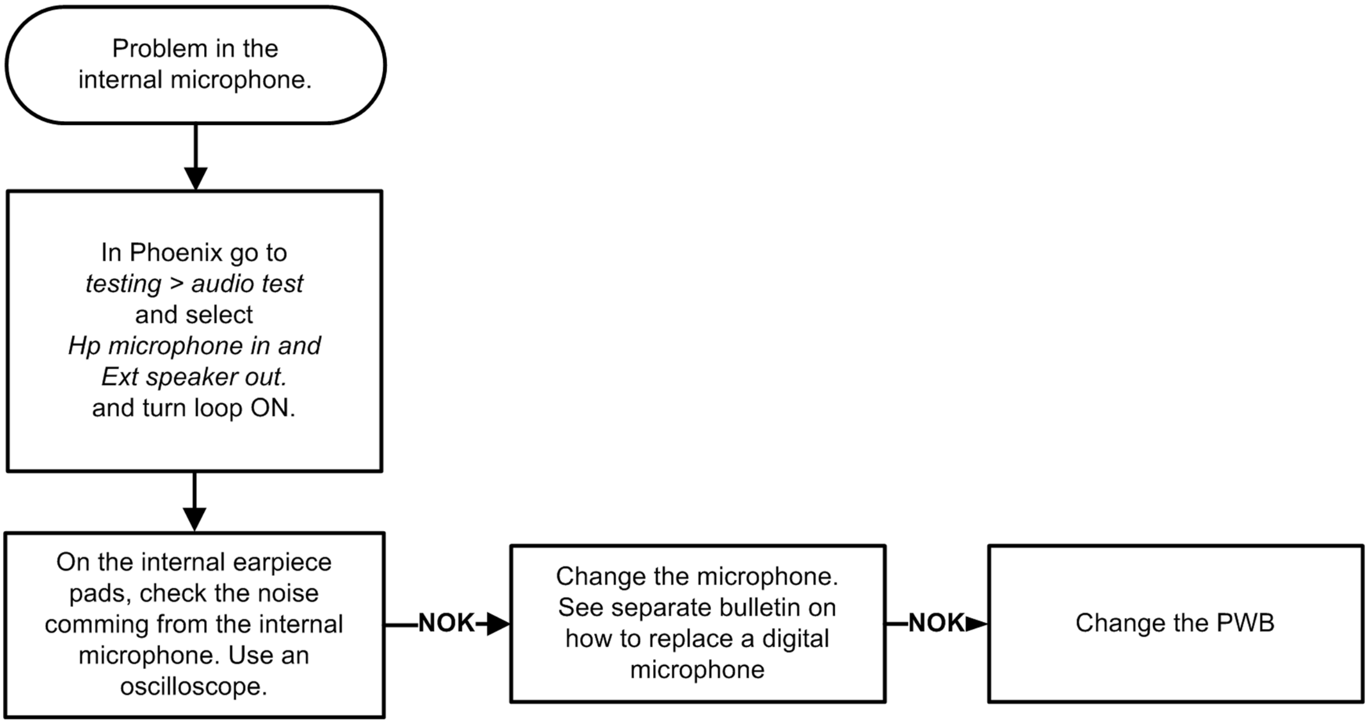
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the internal earpiece
Mesure the resistanse over the earpiece (25-35 Ohm)
NOK
Change earpiece
OK
In Phoenix go to *testing > audio test* and select *Ext microphone in Hp speaker out* and turn loop ON.
Connect a headset to the AV connector (the external microphone will be used as a signal source for the earpiece).
On the internal earpiece pads, check the noise comming from the external microphone. Use an oscilloscope.
NOK
Change the top flex
NOK
Change the PWB

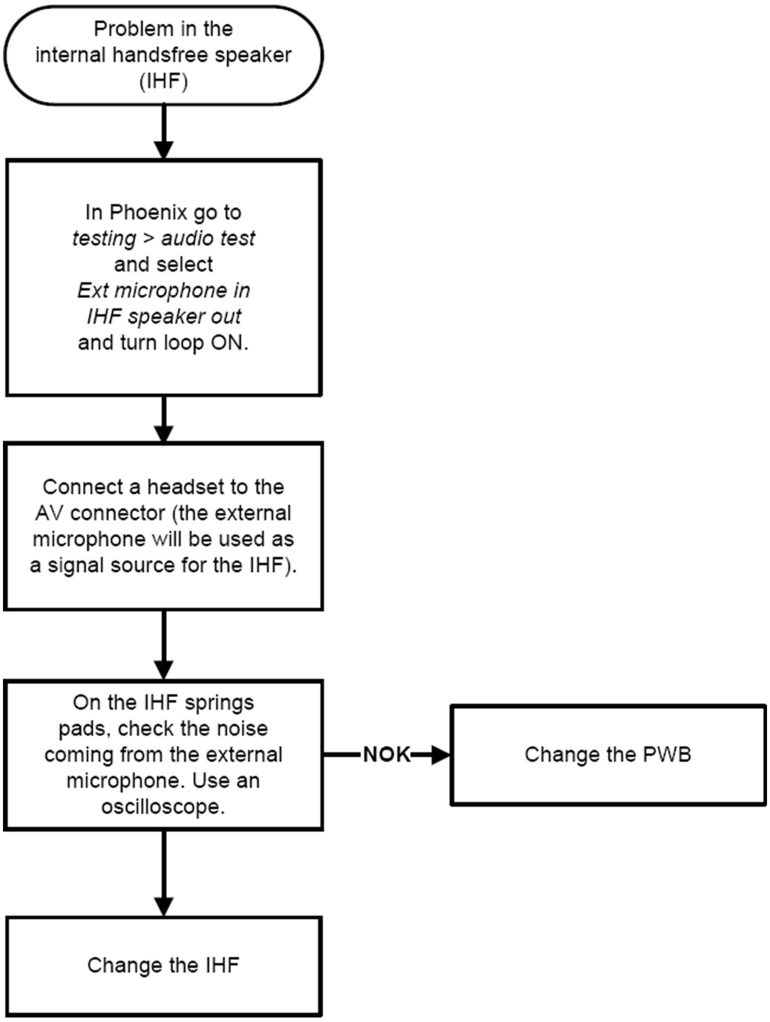
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone.
In Phoenix go to *testing > audio test* and select *Hp microphone in and Ext speaker out.* and turn loop ON.
On the internal earpiece pads, check the noise comming from the internal microphone. Use an oscilloscope.
NOK
Change the microphone. See separate bulletin on how to replace a digital microphone
NOK
Change the PWB

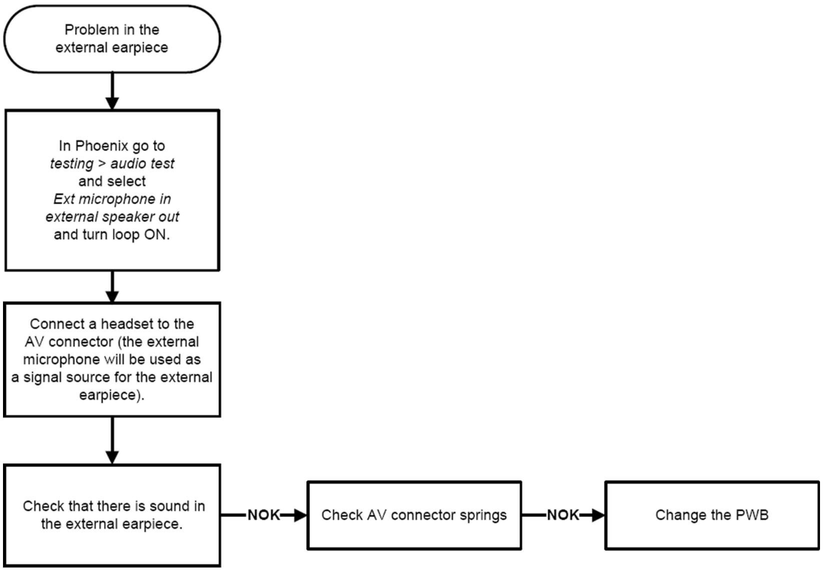
Internal handsfree (IHF) troubleshooting

Troubleshooting flow


Problem in the internal handsfree speaker (IHF)
In Phoenix go to *testing > audio test* and select *Ext microphone in IHF speaker out* and turn loop ON.
Connect a headset to the AV connector (the external microphone will be used as a signal source for the IHF).
On the IHF springs pads, check the noise coming from the external microphone. Use an oscilloscope.
NOK
Change the PWB
Change the IHF

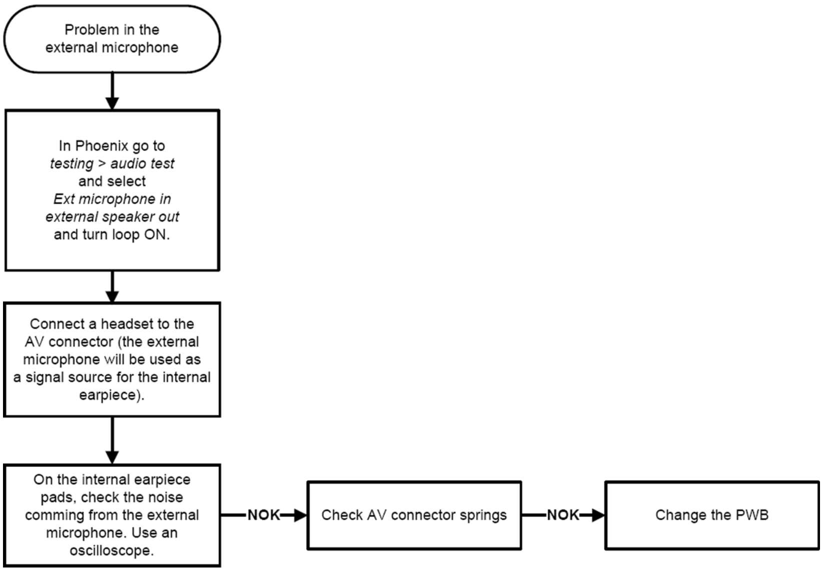
External earpiece troubleshooting

Troubleshooting flow


Problem in the external earpiece
In Phoenix go to *testing > audio test* and select *Ext microphone in external speaker out* and turn loop ON.
Connect a headset to the AV connector (the external microphone will be used as a signal source for the external earpiece).
Check that there is sound in the external earpiece.
NOK
Check AV connector springs
NOK
Change the PWB

External microphone troubleshooting

Troubleshooting flow


Problem in the external microphone
In Phoenix go to *testing > audio test* and select *Ext microphone in external speaker out* and turn loop ON.
Connect a headset to the AV connector (the external microphone will be used as a signal source for the internal earpiece).
On the internal earpiece pads, check the noise comming from the external microphone. Use an oscilloscope.
NOK
Check AV connector springs
NOK
Change the PWB

Acoustics troubleshooting

Introduction to acoustics troubleshooting

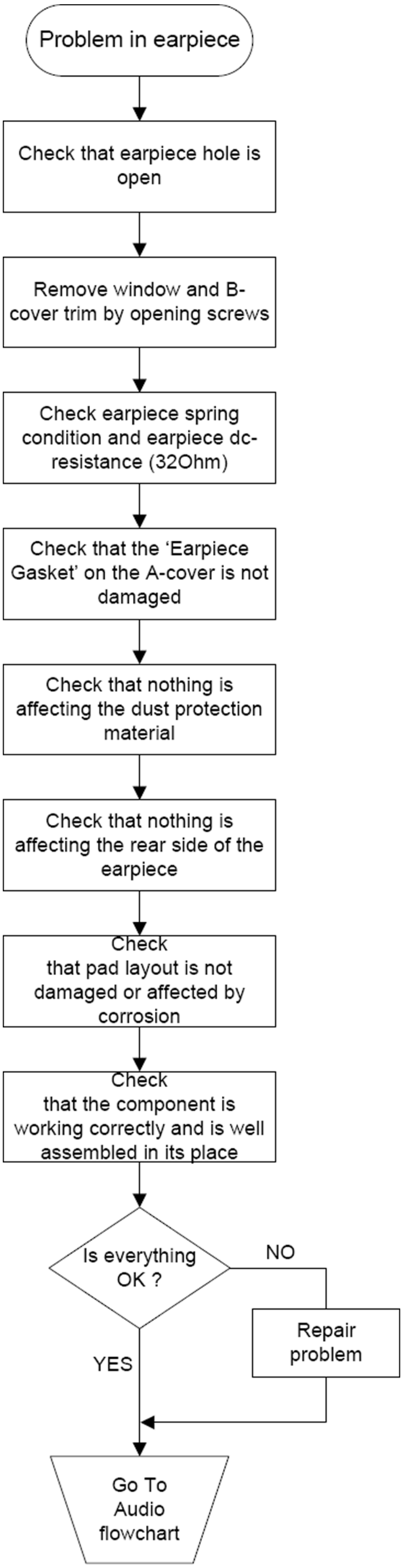
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by speaker(s). The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece radiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker (located under the battery cover) radiates from the sound holes on the battery cover. The microphone is located inside the fold (in the lower block) at the bottom right corner.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

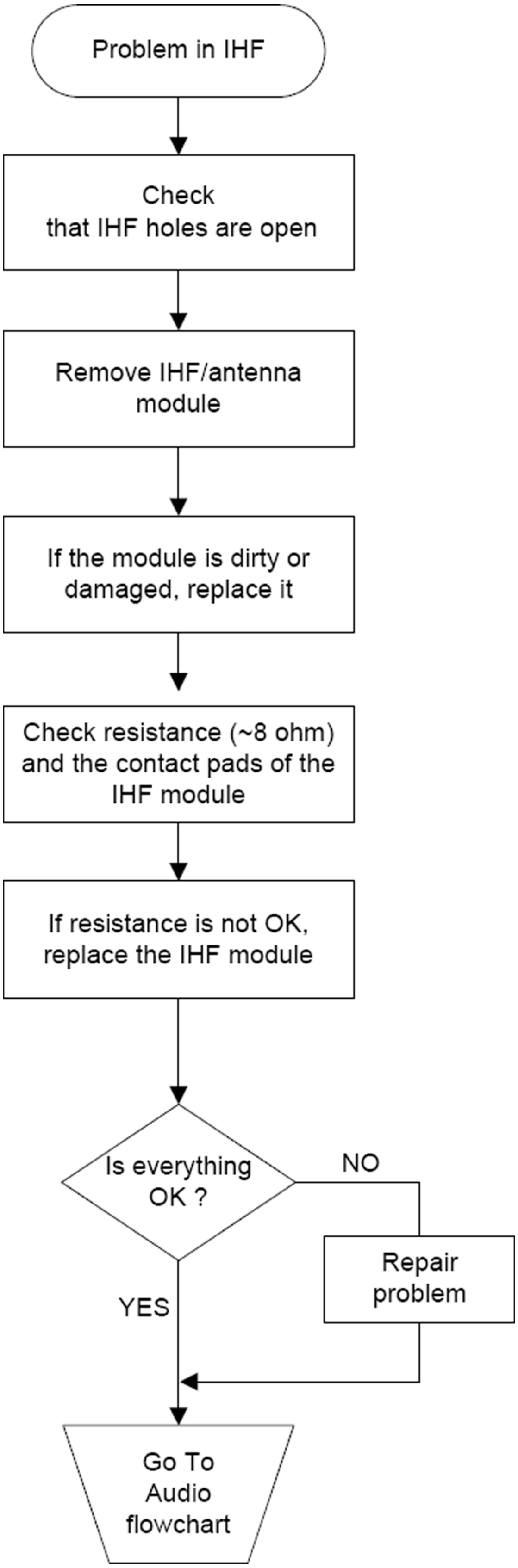
Earpiece troubleshooting

Troubleshooting flow


Problem in earpiece
Check that earpiece hole is open
Remove window and B-cover trim by opening screws
Check earpiece spring condition and earpiece dc-resistance (32Ohm)
Check that the 'Earpiece Gasket' on the A-cover is not damaged
Check that nothing is affecting the dust protection material
Check that nothing is affecting the rear side of the earpiece
Check that pad layout is not damaged or affected by corrosion
Check that the component is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

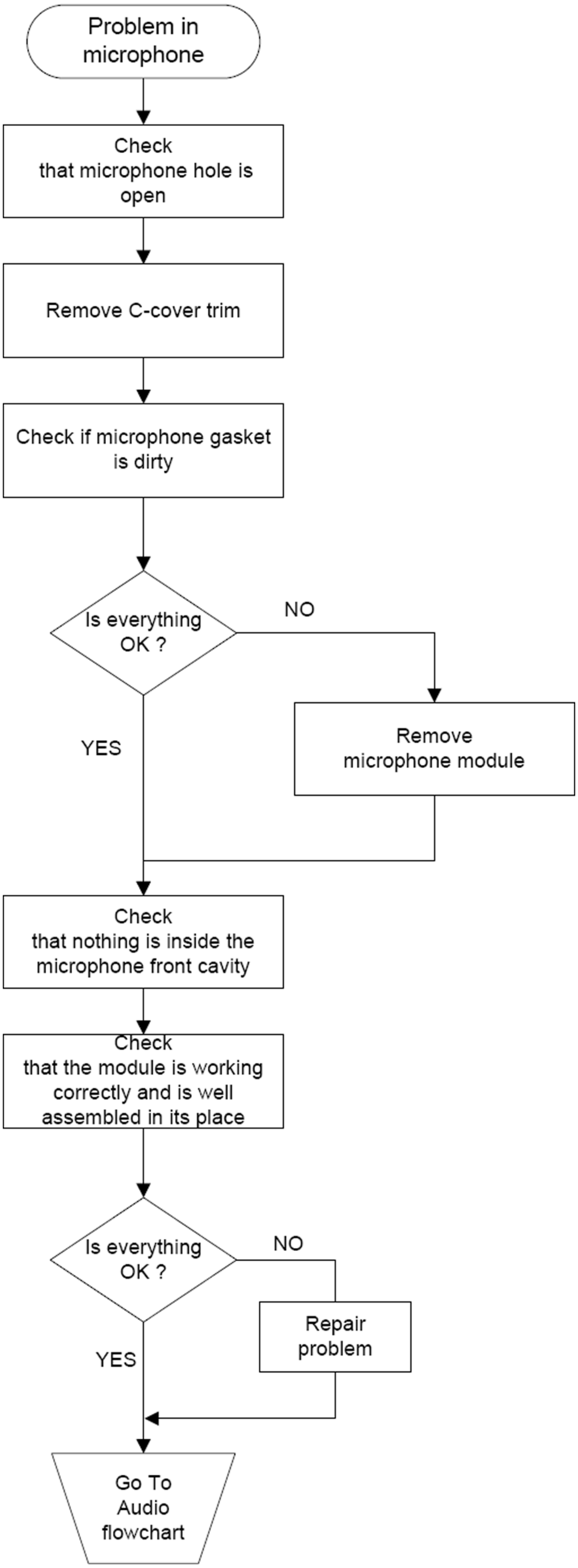
IHF troubleshooting

Troubleshooting flow


Problem in IHF
Check that IHF holes are open
Remove IHF/antenna module
If the module is dirty or damaged, replace it
Check resistance (~8 ohm) and the contact pads of the IHF module
If resistance is not OK, replace the IHF module
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

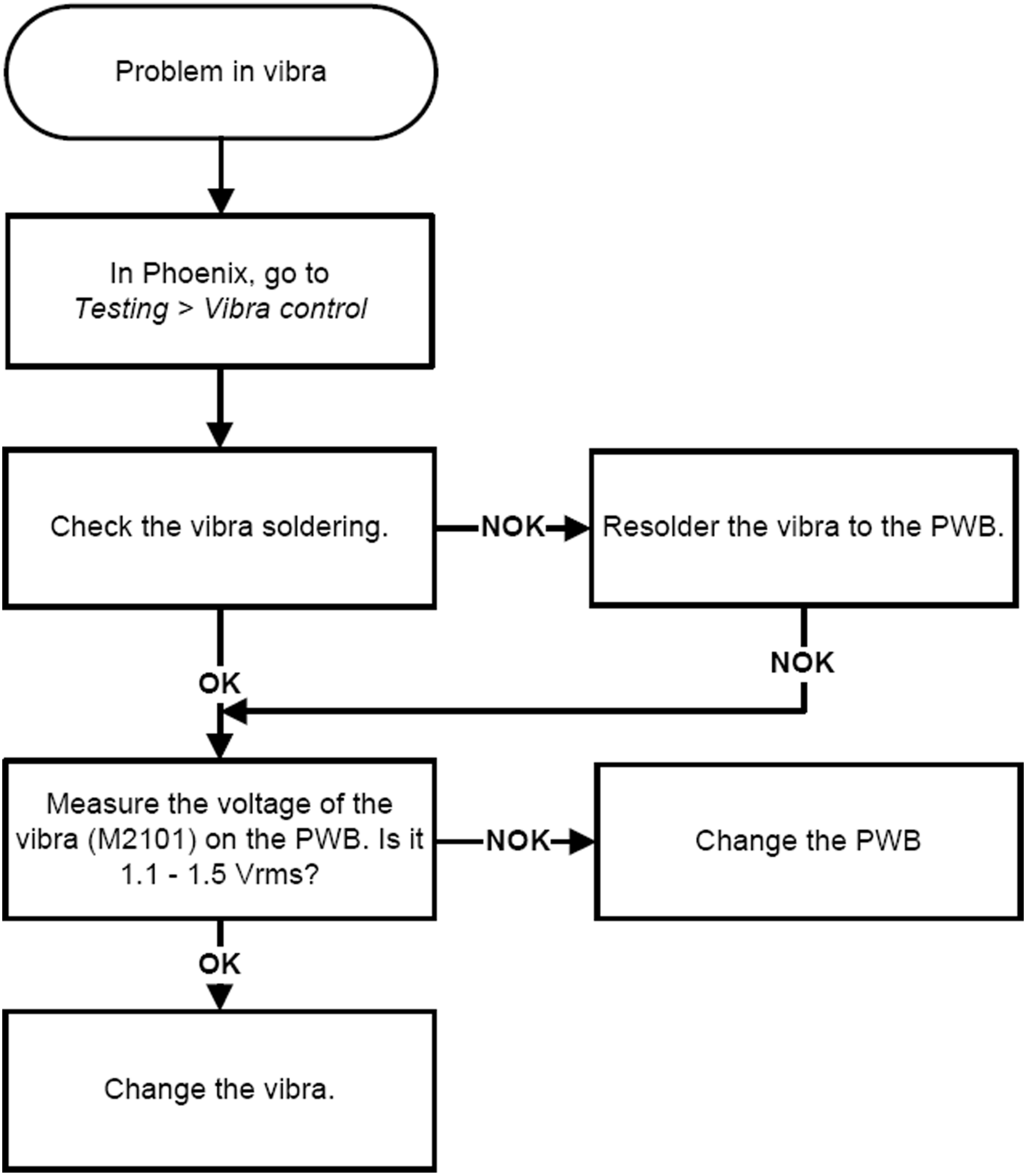
Microphone troubleshooting

Troubleshooting flow


Problem in microphone
Check that microphone hole is open
Remove C-cover trim
Check if microphone gasket is dirty
Is everything OK ?
NO
Remove microphone module
YES
Check that nothing is inside the microphone front cavity
Check that the module is working correctly and is well assembled in its place
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Vibra troubleshooting

Troubleshooting flow


Problem in vibra
In Phoenix, go to *Testing > Vibra control*
Check the vibra soldering.
NOK
Resolder the vibra to the PWB.
NOK
OK
Measure the voltage of the vibra (M2101) on the PWB. Is it 1.1 - 1.5 Vrms?
NOK
Change the PWB
OK
Change the vibra.

Bluetooth and FM radio troubleshooting

Introduction to Bluetooth/FM Radio troubleshooting

There are two main Bluetooth problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB.
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

Bluetooth antenna

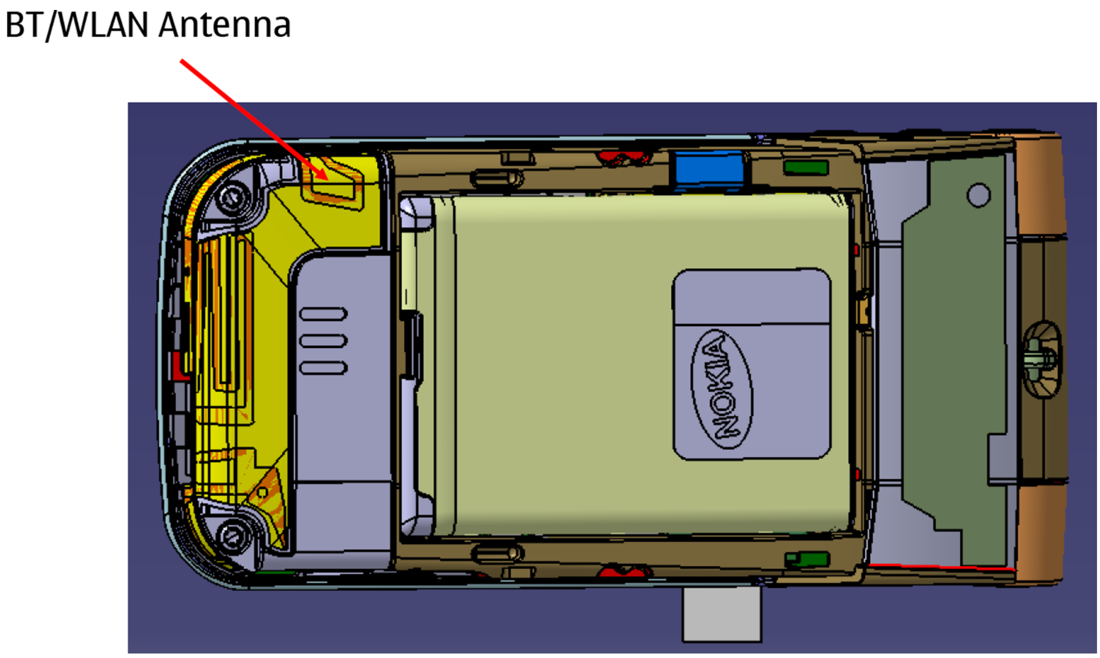


Figure 16 Bluetooth antenna location

Bluetooth/FM Radio component layout

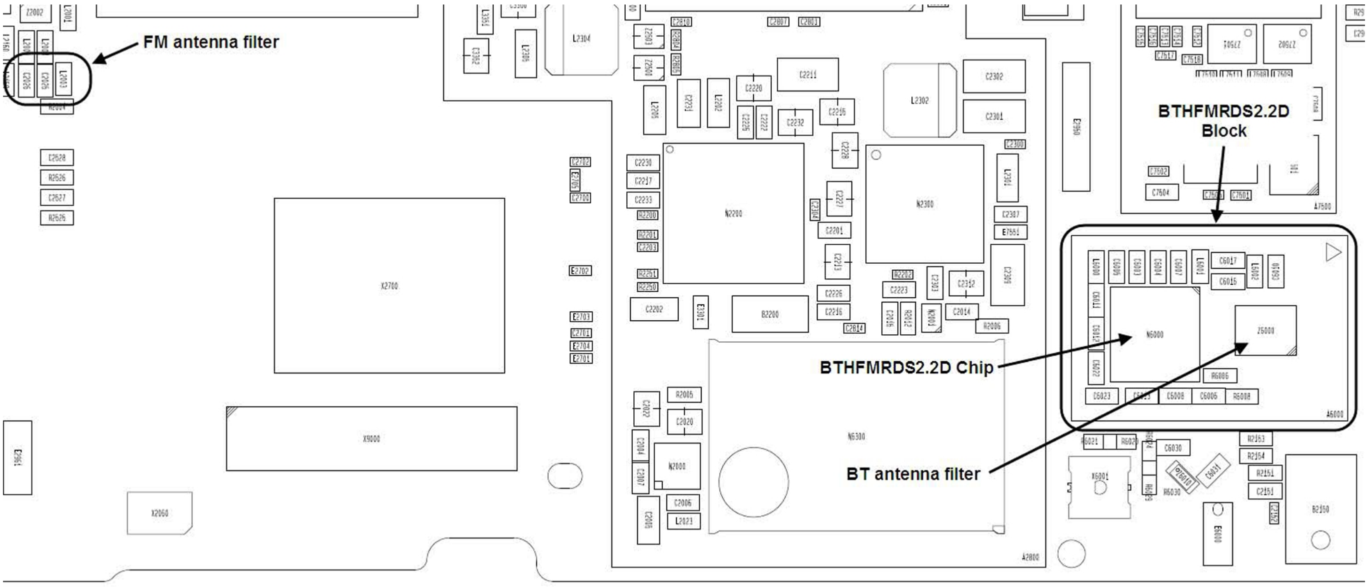


Figure 17 Bluetooth and FM radio component layout

Bluetooth settings for Phoenix

Steps

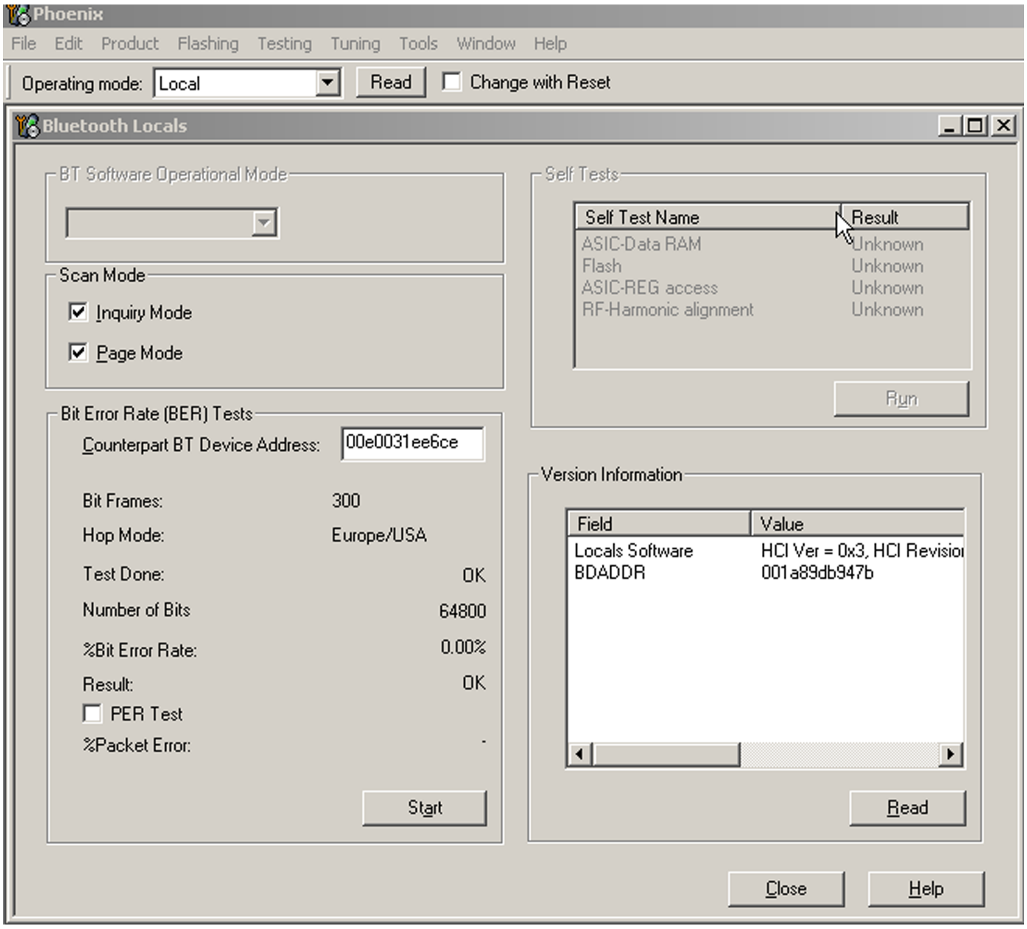
1. Start *Phoenix* service software.
2. Place the phone to a flash adapter in the local mode.
3. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate SB-6’s serial number (12 digits) found in the type label on the back of SB-6.

   In addition to SB-6 , also JBT-3, JBT-6 and JBT-9 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that SB-6 is not changed.
7. Place the SB-6 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Read
Bluetooth Locals
BT Software Operational Mode
Scan Mode
Bit Error Rate (BER) Tests
Self Tests
Run
Version Information
Start
Read
Close
Help

Operating mode: Local

☐ Change with Reset

☑ Inquiry Mode

☑ Page Mode

Counterpart BT Device Address: 00e0031ee6ce

Bit Frames: 300

Hop Mode: Europe/USA

Test Done: OK

Number of Bits 64800

%Bit Error Rate: 0.00%

Result: OK

☐ PER Test

%Packet Error: -

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Field	Value
Locals Software	HCI Ver = 0x3, HCI Revisio
BDADDR	001a89db947b

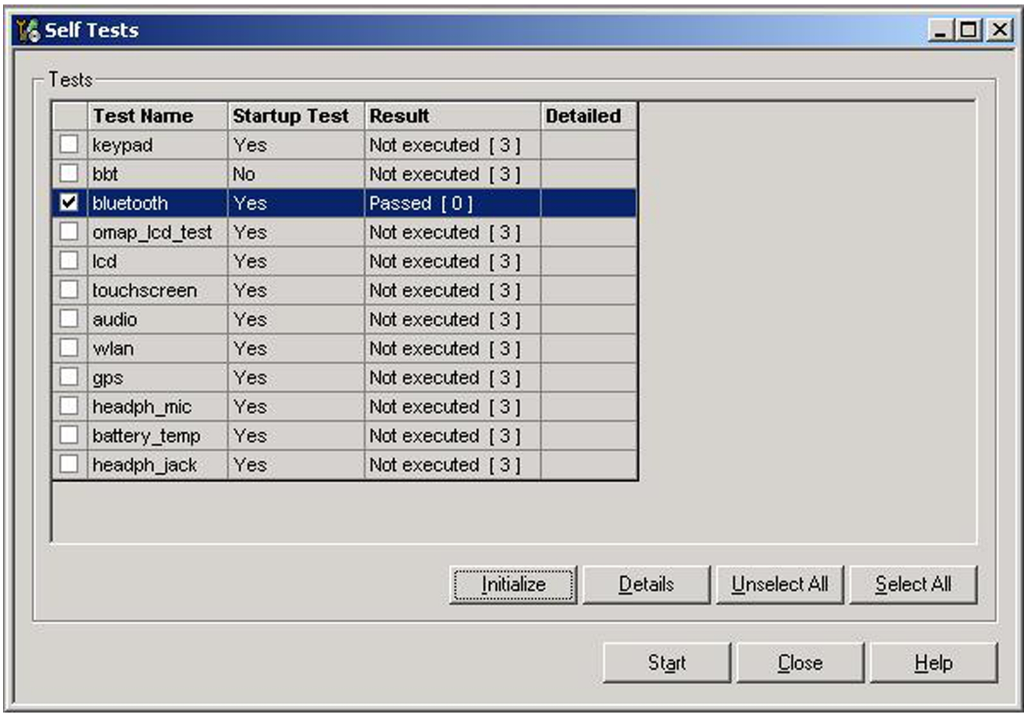
Figure 18 BER test result

Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose**File**→**Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing**→**Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**
   - **ST_BT_WAKEUP_TEST**

7. To run the tests, click **Start**.


Self Tests
Tests
Initialize
Details
Unselect All
Select All
Start
Close
Help

	Test Name	Startup Test	Result	Detailed
☐	keypad	Yes	Not executed [3]	
☐	bbt	No	Not executed [3]	
☑	bluetooth	Yes	Passed [0]	
☐	omap_lcd_test	Yes	Not executed [3]	
☐	lcd	Yes	Not executed [3]	
☐	touchscreen	Yes	Not executed [3]	
☐	audio	Yes	Not executed [3]	
☐	wlan	Yes	Not executed [3]	
☐	gps	Yes	Not executed [3]	
☐	headph_mic	Yes	Not executed [3]	
☐	battery_temp	Yes	Not executed [3]	
☐	headph_jack	Yes	Not executed [3]	

Figure 19 Bluetooth self tests in *Phoenix*

Bluetooth troubleshooting

Troubleshooting flow

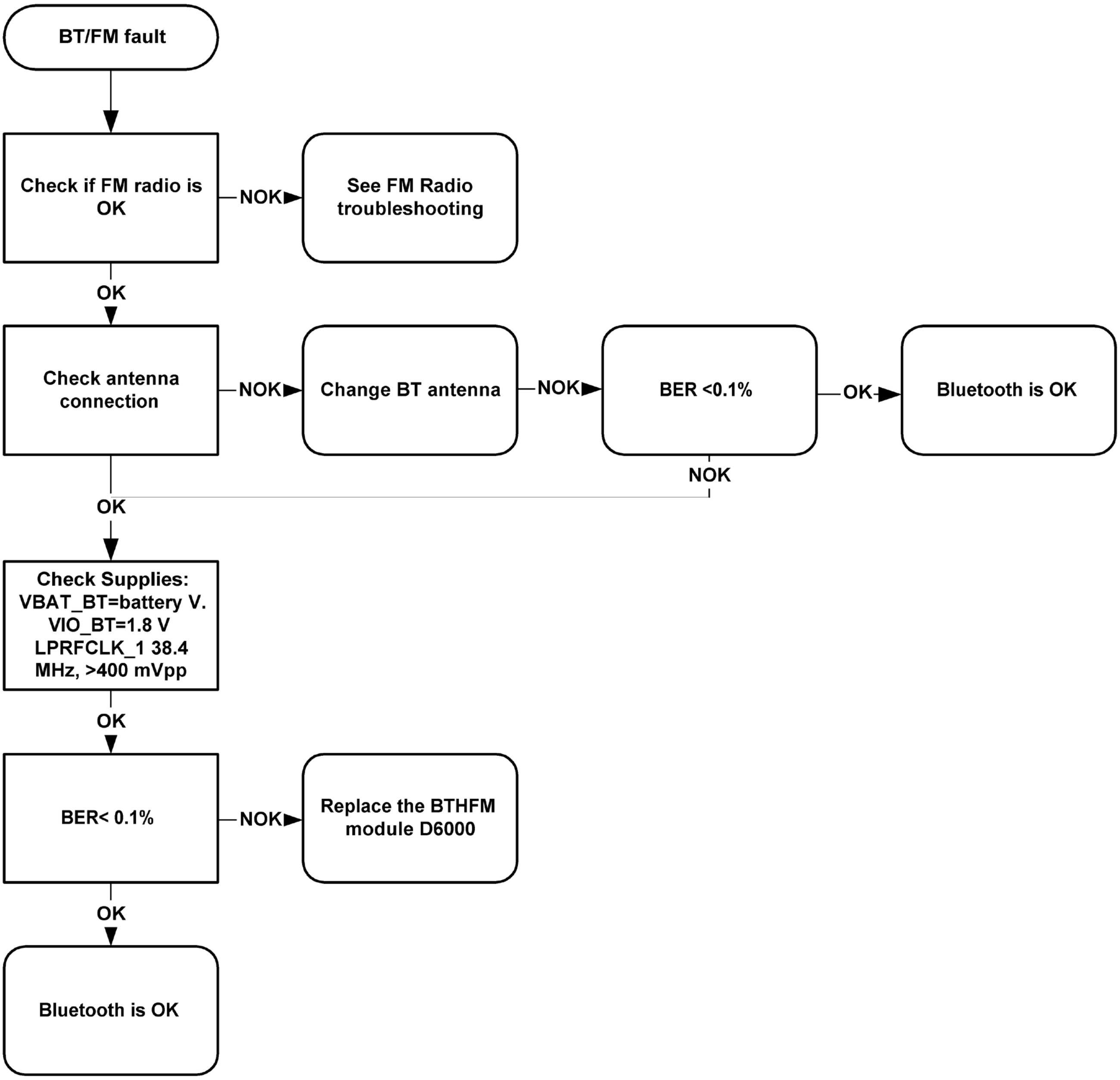

BT/FM fault
Check if FM radio is OK
NOK
See FM Radio troubleshooting
OK
Check antenna connection
NOK
Change BT antenna
NOK
BER <0.1%
OK
Bluetooth is OK
NOK
OK
Check Supplies:
VBAT_BT=battery V.
VIO_BT=1.8 V
LPRFCLK_1 38.4 MHz, >400 mVpp
OK
BER< 0.1%
NOK
Replace the BTHFM module D6000
OK
Bluetooth is OK

Figure 20 Troubleshooting diagram: Bluetooth

FM radio troubleshooting

Troubleshooting flow

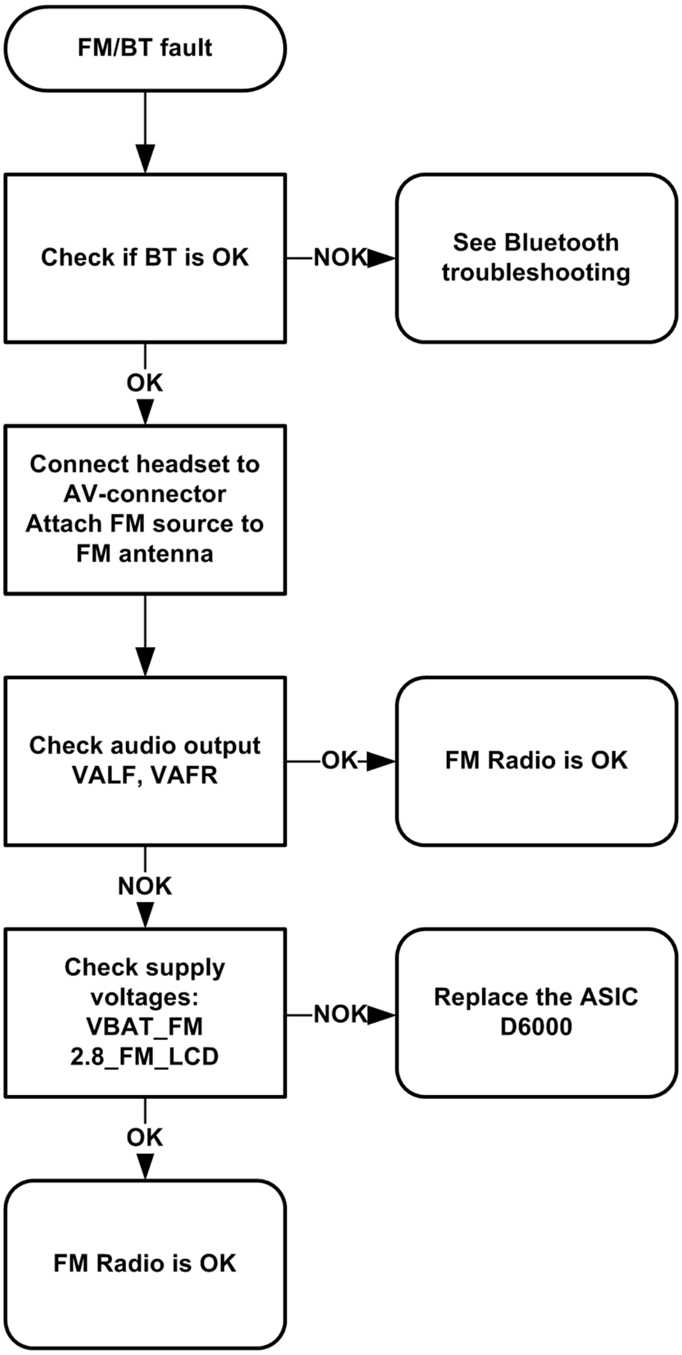

FM/BT fault
Check if BT is OK
NOK
See Bluetooth troubleshooting
OK
Connect headset to AV-connector
Attach FM source to FM antenna
Check audio output VALF, VAFR
OK
FM Radio is OK
NOK
Check supply voltages:
VBAT_FM
2.8_FM_LCD
NOK
Replace the ASIC D6000
OK
FM Radio is OK

Figure 21 Troubleshooting diagram: FM radio

Baseband manual tuning guide

Certificate restoring

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-10 or FPS-21.

  Note: USB flashing does not work for a dead BB5 phone.
- Execute the certificate restore process in Phoenix.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2008.38. or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables testing and tuning features)
- Activated FPS-10 flash prommer **OR** FPS-21 flash prommer
- Latest flash update package for FPS-10 or FPS-21 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.
2. Execute the certificate restore process in Phoenix.

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).

2. Start *Phoenix* service software.
3. Choose **File→ Scan Product.**
4. Choose **Tuning→Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 10 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

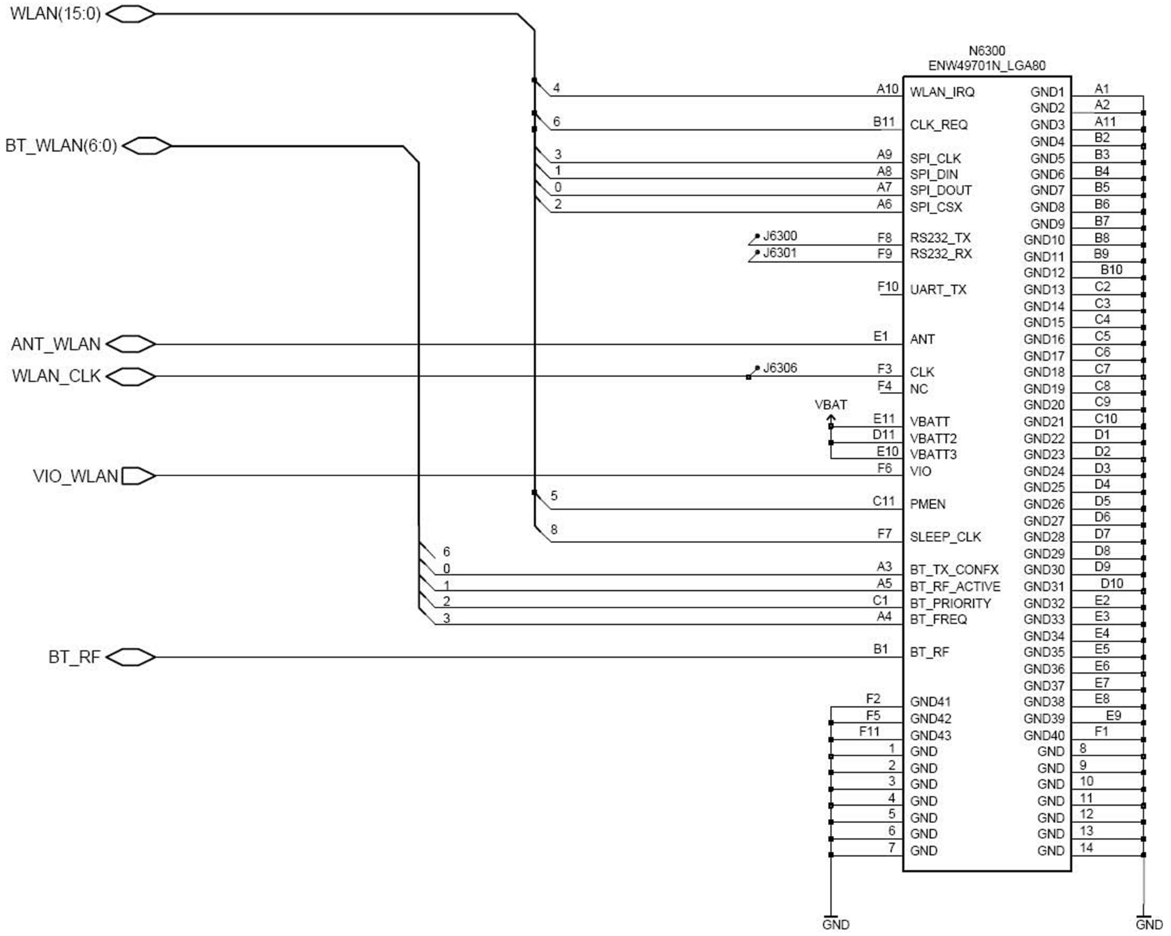
9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

RM-399 WLAN troubleshooting

WLAN layout and test points

The WLAN module has been optimised to achieve the smallest possible PWB area and adding test points will compromise this layout efficiency. There is also an added risk that test point will compromise the WLAN performance – the layout is quite sensitive and there have been EMC issues that were directly attributed to use of test points.

The recommendation is to use no test points and use software tests in Phoenix to verify the operation of the WLAN module. For reference, all test points provided on the schematic are summarised below.


WLAN(15:0)
BT_WLAN(6:0)
ANT_WLAN
WLAN_CLK
VIO_WLAN
BT_RF
N6300
ENW49701N_LGA80
WLAN_IRQ
CLK_REQ
SPI_CLK
SPI_DIN
SPI_DOUT
SPI_CSX
RS232_TX
RS232_RX
UART_TX
ANT
CLK
NC
VBATT
VBATT2
VBATT3
VIO
PMEN
SLEEP_CLK
BT_TX_CONFX
BT_RF_ACTIVE
BT_PRIORITY
BT_FREQ
BT_RF
GND41
GND42
GND43
J6300
J6301
J6306
VBAT
GND
GND

The sequence of events during the start up of WLAN is:

1 PMEM is asserted high when Wlan module is first enabled by the Host.

2 WLAN module should respond by driving CLK REQ high to request the 38.4MHz clock.

3 Host engine turns on the 38.4MHz clock and then generates the SPI Clock to start the download of software to the WLAN module.

Adding more test points in a product is not strictly necessary.

WLAN settings for Phoenix

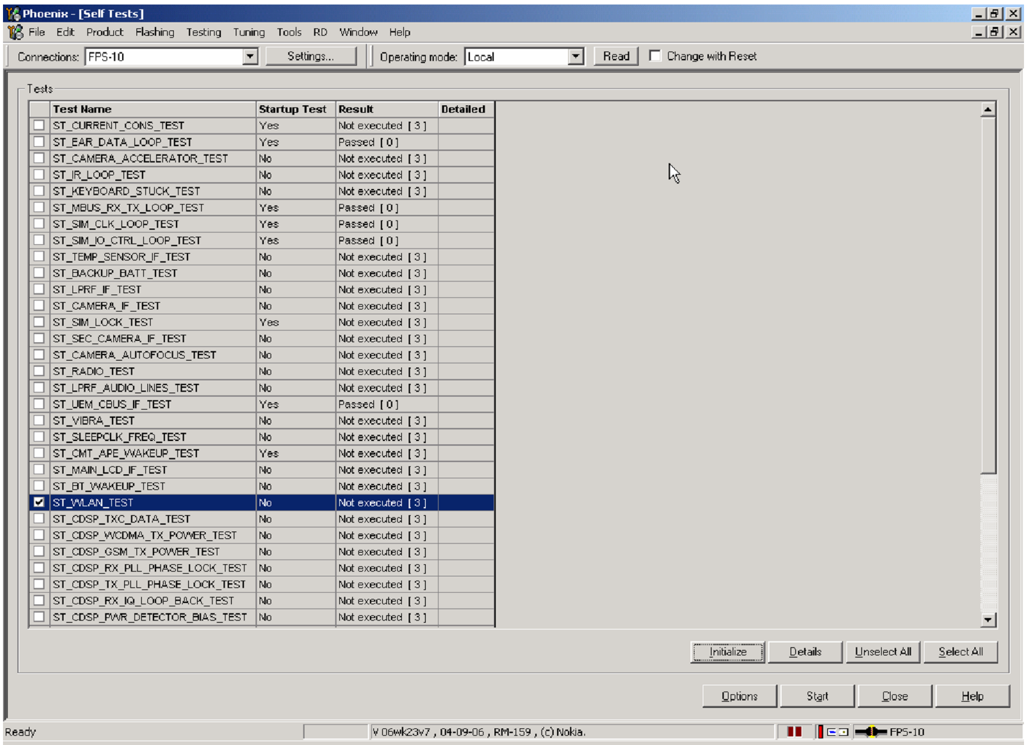
Use the following to test WLAN using Phoenix:

1 Set phone into Local Mode .

2 From the **File** menu, select **Scan Product** and check that the correct product version is displayed

3 From the **Testing** menu, select **Self Test**. This opens up a Self Test dialogue box, as shown below.

Select the **ST_WLAN_TEST** check box as shown and then select **Start** button. The test turns on the WLAN, sets up the SPI interface and then downloads the WLAN firmware into the WLAN module. During the download the WLAN acknowledges the data blocks and so the self test is a good way to confirm that the WLAN module is communicating with the Host. The result column will change to **Passed** after a few seconds if operating properly.


Phoenix - [Self Tests]
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
Tests
Initialize
Details
Unselect All
Select All
Options
Start
Close
Help

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

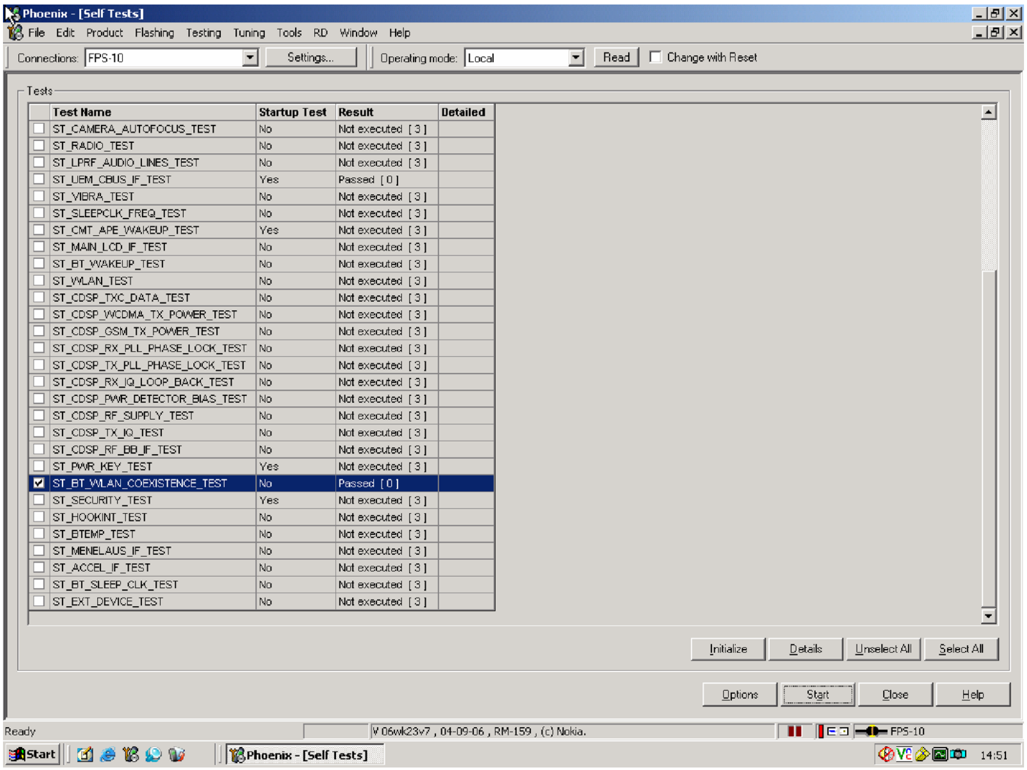
	Test Name	Startup Test	Result	Detailed
☐	ST_CURRENT_CONS_TEST	Yes	Not executed [3]	
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_CAMERA_ACCELERATOR_TEST	No	Not executed [3]	
☐	ST_IR_LOOP_TEST	No	Not executed [3]	
☐	ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
☐	ST_MBUS_RX_TX_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_TEMP_SENSOR_IF_TEST	No	Not executed [3]	
☐	ST_BACKUP_BATT_TEST	No	Not executed [3]	
☐	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☐	ST_SEC_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_AUTOFOCUS_TEST	No	Not executed [3]	
☐	ST_RADIO_TEST	No	Not executed [3]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_VIBRA_TEST	No	Not executed [3]	
☐	ST_SLEEPCLK_FREQ_TEST	No	Not executed [3]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☑	ST_WLAN_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	
☐	ST_CDSP_WCDMA_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_GSM_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Not executed [3]	
☐	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Not executed [3]	

Ready | V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia. | FPS-10

In addition, a test of the WLAN to BT interface can be done by selecting the **ST_BT_WLAN_COEXISTENCE_TEST** check box and selecting Start button.

This test verifies that the WLAN to BT co-existence interface signals are properly connected and there are no open circuit or shorts on the four interface signals.

The co-existence interface comprises BT Txconfig, BT RF Active, BT Priority, and BT Frequency.


Phoenix - [Self Tests]
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
Tests
Initialize
Details
Unselect All
Select All
Options
Start
Close
Help
Start
Phoenix - [Self Tests]
14:51

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

	Test Name	Startup Test	Result	Detailed
☐	ST_CAMERA_AUTOFOCUS_TEST	No	Not executed [3]	
☐	ST_RADIO_TEST	No	Not executed [3]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_VIBRA_TEST	No	Not executed [3]	
☐	ST_SLEEPCLK_FREQ_TEST	No	Not executed [3]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☐	ST_WLAN_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	
☐	ST_CDSP_WCDMA_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_GSM_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Not executed [3]	
☐	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_SUPPLY_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_IQ_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_BB_IF_TEST	No	Not executed [3]	
☐	ST_PWR_KEY_TEST	Yes	Not executed [3]	
☑	ST_BT_WLAN_COEXISTENCE_TEST	No	Passed [0]	
☐	ST_SECURITY_TEST	Yes	Not executed [3]	
☐	ST_HOOKINT_TEST	No	Not executed [3]	
☐	ST_BTEMP_TEST	No	Not executed [3]	
☐	ST_MENELAUS_IF_TEST	No	Not executed [3]	
☐	ST_ACCEL_IF_TEST	No	Not executed [3]	
☐	ST_BT_SLEEP_CLK_TEST	No	Not executed [3]	
☐	ST_EXT_DEVICE_TEST	No	Not executed [3]	

Ready | V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia. | FPS-10

In summary these two Self tests provide a simple means of ensuring the Host engine is able to communicate with the WLAN module and check the interface to BT. More detailed WLAN performance test is covered in WLAN functional test section.

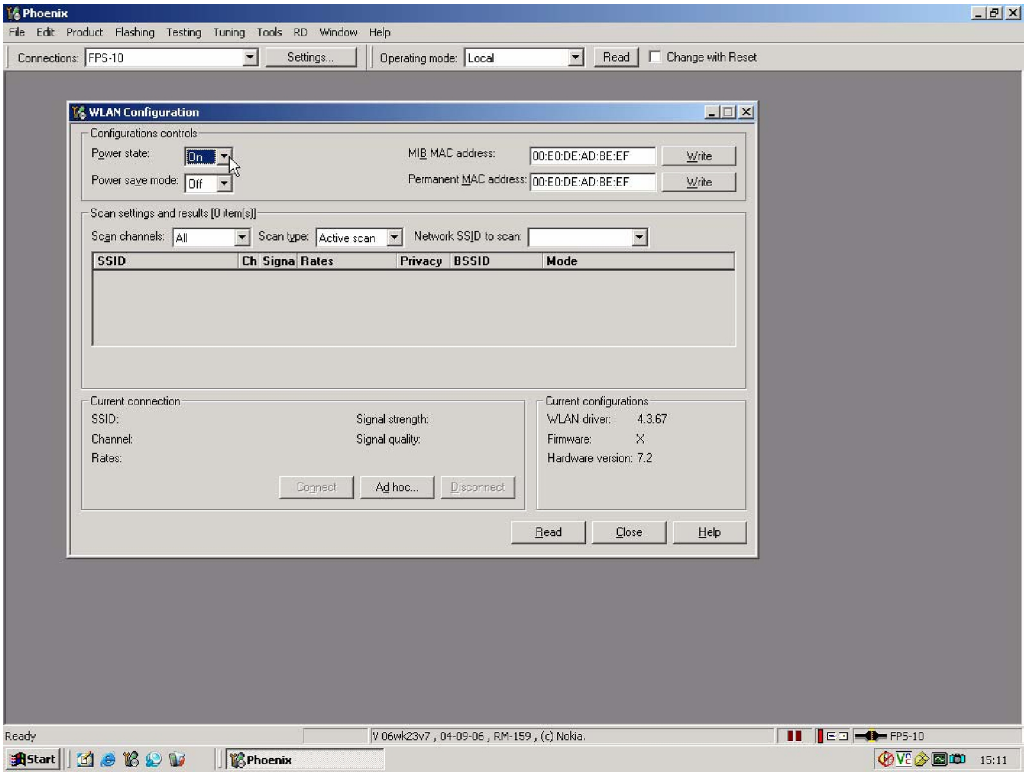
WLAN functional tests

On/Off test

From the testing toolbar select **WLAN Configuration** option. This opens the WLAN configuration dialogue box below. Selecting the Power state option button (as indicated), the WLAN can be turned ON and OFF:

1. With Power State set to OFF, measure the dc power supply current consumption of the flash adaptor.
2. Next return the Power state to ON and re-measure the dc power supply current of the flash adaptor.

The difference between the currents in (1) and (2) should be between 160 to 200mA. When WLAN is ON, the firmware has been downloaded and the WLAN module is in the receive state. When OFF WLAN is powered down.



Connections: FPS-10
Operating mode: Local
☐ Change with Reset

WLAN Configuration

Configurations controls
Power state: On
Power save mode: Off
MIB MAC address: 00:E0:DE:AD:BE:EF
Permanent MAC address: 00:E0:DE:AD:BE:EF

Scan settings and results [0 item(s)]
Scan channels: All
Scan type: Active scan
Network SSID to scan:

SSID	Ch	Signa	Rates	Privacy	BSSID	Mode

Current connection
SSID:
Channel:
Rates:
Signal strength:
Signal quality:

Current configurations
WLAN driver: 4.3.67
Firmware: X
Hardware version: 7.2

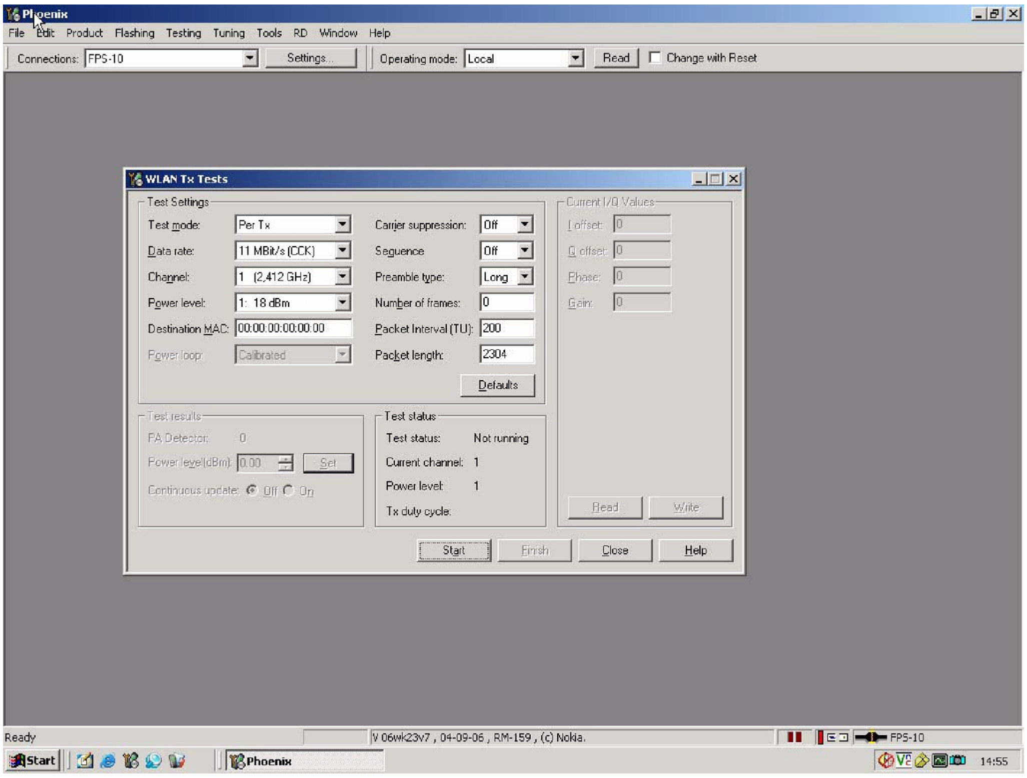
Ready
V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.
FPS-10

TX tests

From the testing toolbar select WLAN Tx Test option shown below. This test can be used to verify TX configuration and functionality. The default settings are sufficient for testing the TX operation, although other channels and data rates are equally suitable. To start the test, select the Start option button:

1. Measure and record the TX ON current consumption of the Phone/ flash adaptor.
2. Monitor the WLAN TX spectrum on a Spectrum analyser either using a co-ax cable connected to the WLAN TX antenna port or by making a radiated test with a suitable WLAN antenna connected to the spectrum analyser input. (When making a radiated test ensure that other WLAN devices are not transmitting as these may be detected as well, confusing the result).
3. To finish the test select the Finish option button
4. Measure the TX OFF current consumption of the phone/flash adaptor.

The difference between the two readings should be 100mA – 130mA and measures the transmit current in 11MBPS, 802.11b mode of operation.


Phoenix
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
☐ Change with Reset
WLAN Tx Tests
Test Settings
Current I/Q Values
Defaults
Test results
Test status
Read
Write
Start
Finish
Close
Help
Ready
V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.
FPS-10
Start
Phoenix
14:55

Connections: FPS-10
Operating mode: Local

Test mode: Per Tx
Data rate: 11 MBit/s (CCK)
Channel: 1 (2,412 GHz)
Power level: 1: 18 dBm
Destination MAC: 00:00:00:00:00:00
Power loop: Calibrated
Carrier suppression: Off
Sequence: Off
Preamble type: Long
Number of frames: 0
Packet Interval (TU): 200
Packet length: 2304

I offset: 0
Q offset: 0
Phase: 0
Gain: 0

PA Detector: 0
Power level(dBm): 0.00
Continuous update: ● Off ○ On

Test status: Not running
Current channel: 1
Power level: 1
Tx duty cycle:

RX Tests

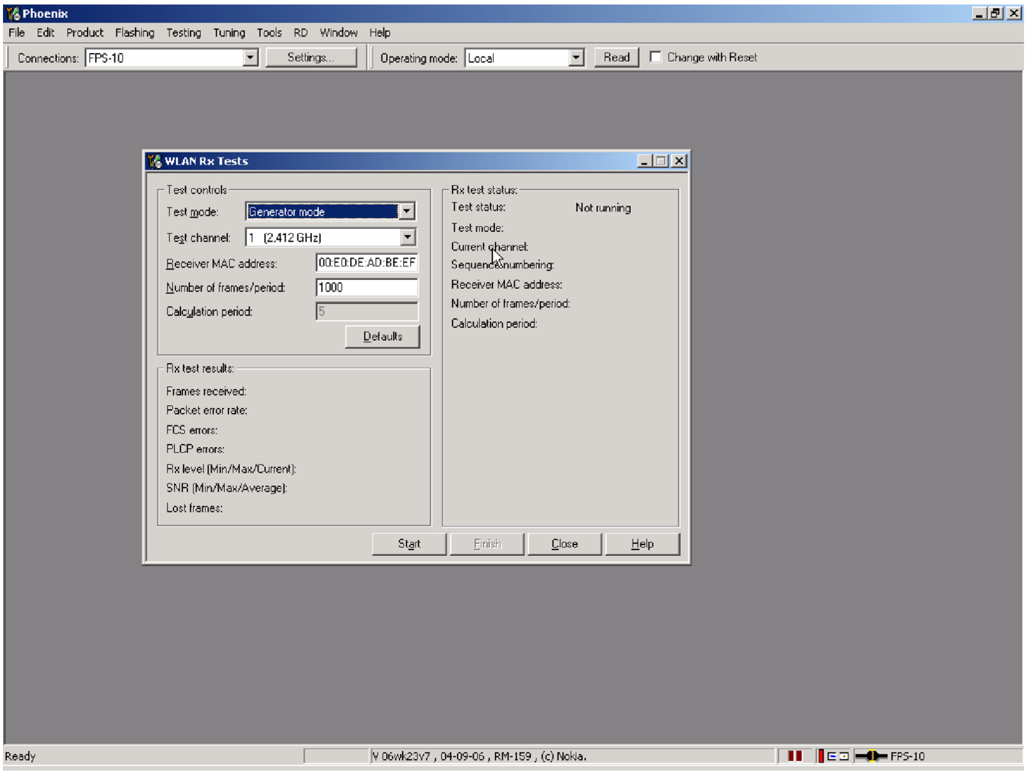
There are different options available for testing the Rx path. The simplest is to use the WLAN to report Rx packets when operating in an area where there is an active WLAN network. Simply starting an Rx test will show the number of packets detected by the WLAN module as it monitors the network. However, it does require a properly configured WLAN network. The alternative approach is to make a conducted test using a signal generator connected to the WLAN antenna port. The drawback in this approach is that the WLAN antenna connection in the phone is not actually tested.

From the testing toolbar select WLAN Rx Test option shown below. This test can be used to verify Rx configuration and functionality.

To start the test, select the Start option button.

As the WLAN monitors an active WLAN network, the Rx test results window will update and show the number of Frames received, as well as the Packer error rate. If there is no data reported in the "Rx test results" screen, please change the "test channel" number.

Monitoring the detected frames is a simple method to verify the WLAN antenna and receiver path is working properly. The current consumption of the phone/flash adaptor before and during the Rx test should be the same (10 mA max difference).


Phoenix
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
WLAN Rx Tests
Test controls
Defaults
Rx test results:
Rx test status:
Start
Finish
Close
Help

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

Test mode: Generator mode

Test channel: 1 (2.412 GHz)

Receiver MAC address: 00:E0:DE:AD:BE:EF

Number of frames/period: 1000

Calculation period: 5

Frames received:
Packet error rate:
FCS errors:
PLCP errors:
Rx level (Min/Max/Current):
SNR (Min/Max/Average):
Lost frames:

Test status: Not running
Test mode:
Current channel:
Sequence numbering:
Receiver MAC address:
Number of frames/period:
Calculation period:

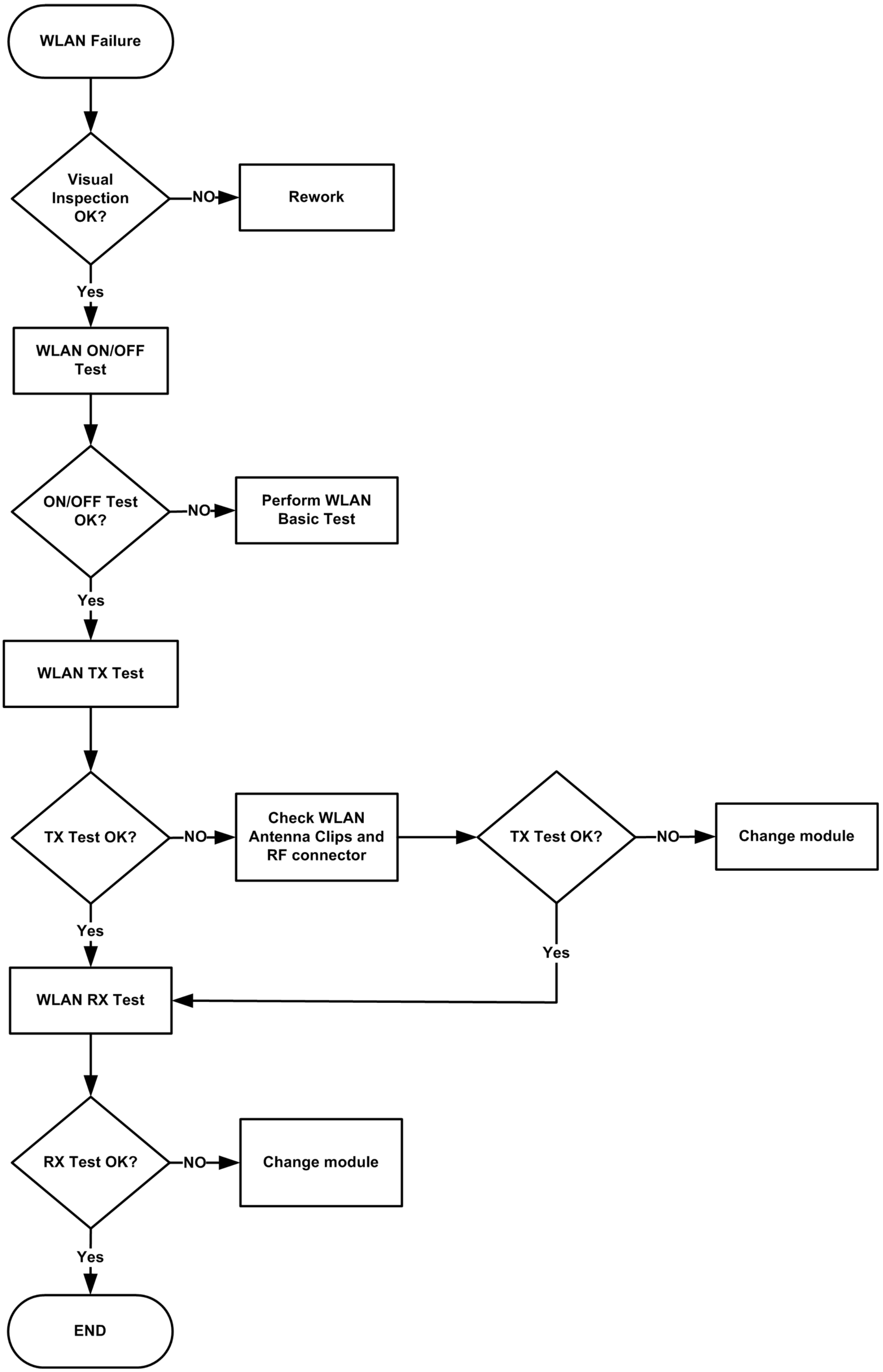
Ready

V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.

FPS-10

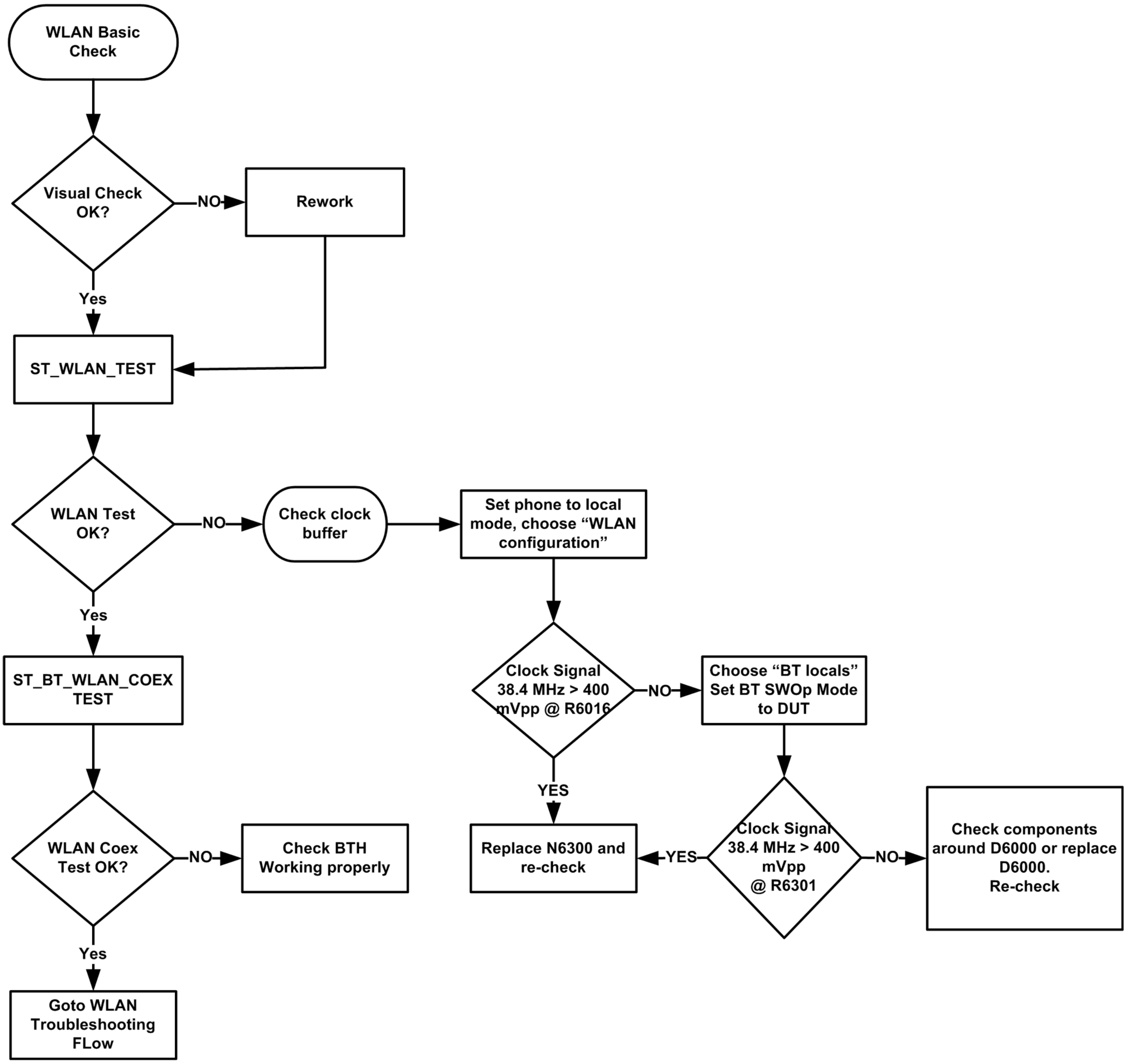
WLAN failure troubleshooting

Troubleshooting flow


WLAN Failure
Visual Inspection OK?
NO
Rework
Yes
WLAN ON/OFF Test
ON/OFF Test OK?
NO
Perform WLAN Basic Test
Yes
WLAN TX Test
TX Test OK?
NO
Check WLAN Antenna Clips and RF connector
TX Test OK?
NO
Change module
Yes
Yes
WLAN RX Test
RX Test OK?
NO
Change module
Yes
END

WLAN basic checks troubleshooting

Troubleshooting flow


WLAN Basic Check
Visual Check OK?
NO
Rework
Yes
ST_WLAN_TEST
WLAN Test OK?
NO
Check clock buffer
Set phone to local mode, choose “WLAN configuration”
Clock Signal 38.4 MHz > 400 mVpp @ R6016
NO
Choose “BT locals” Set BT SWOp Mode to DUT
YES
Yes
ST_BT_WLAN_COEX TEST
WLAN Coex Test OK?
NO
Check BTH Working properly
Replace N6300 and re-check
YES
Clock Signal 38.4 MHz > 400 mVpp @ R6301
NO
Check components around D6000 or replace D6000. Re-check
Yes
Goto WLAN Troubleshooting FLow

4 — RF Troubleshooting

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  Running RF self tests with Phoenix 4–5
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  Troubleshooting with RF self tests 4–8
    RF self test troubleshooting overview 4–8
    RF-BB interface troubleshooting (ST_CDSP_RF_BB_IF_TEST) 4–9
    Power supply troubleshooting (ST_CDSP_RF_SUPPLY_TEST) 4–10
    PLL self test troubleshooting (ST_CDSP_PLL_PHASE_LOCK_TEST) 4–10
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RF key components

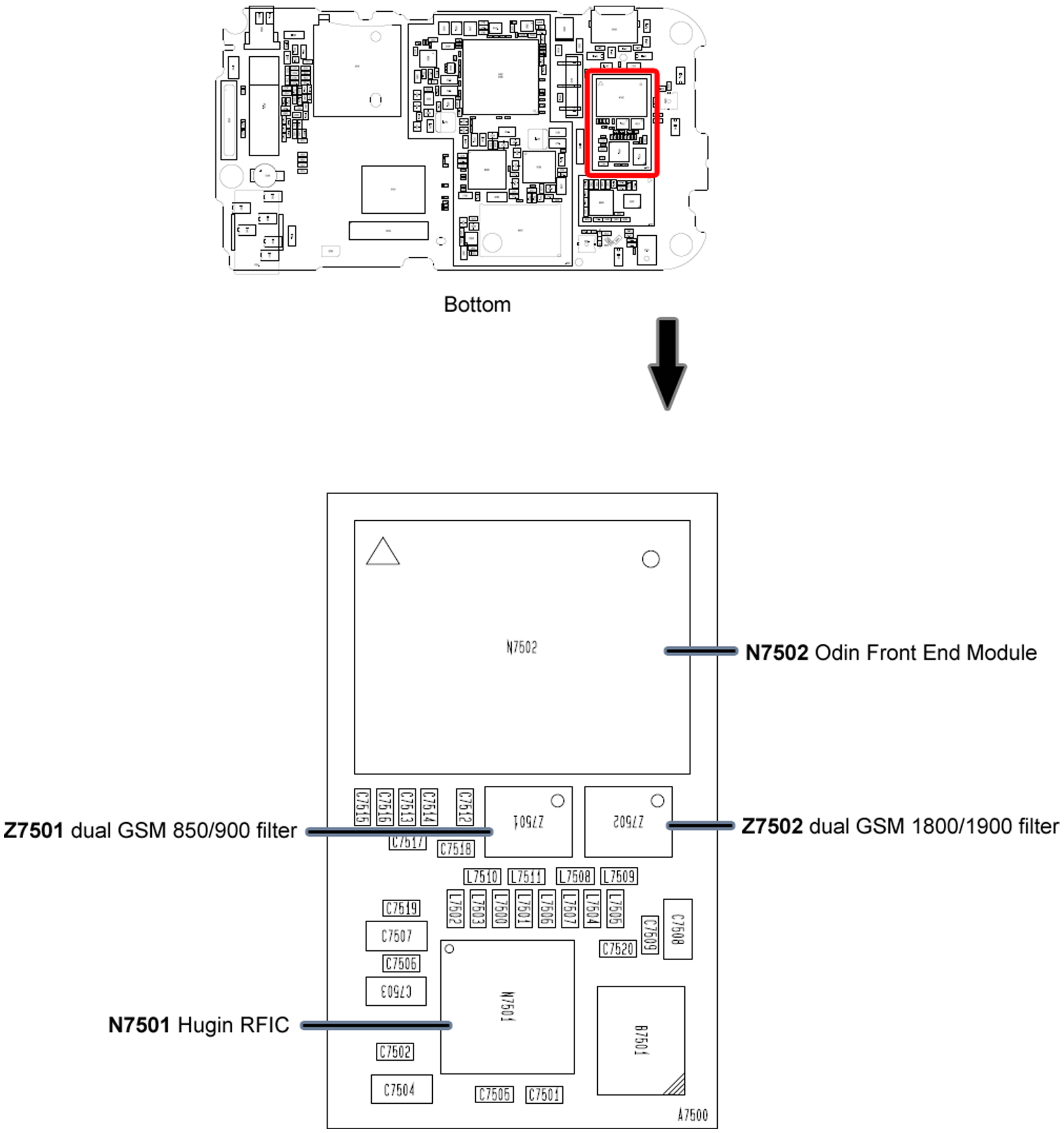

Bottom
N7502 Odin Front End Module
Z7501 dual GSM 850/900 filter
Z7502 dual GSM 1800/1900 filter
N7501 Hugin RFIC
N7502
Z7501
Z7502
N7501
B7501
A7500

Figure 22 RF key components - bottom

RF self tests

Running RF self tests with Phoenix

Prerequisites

Caution: The RF connector should be terminated to 50 Ohms or connected to the antenna. Check this carefully before performing the self tests, otherwise the PA may be damaged.

The order in which the self tests must be executed is specified below:

1 **ST_CDSP_RF_BB_IF_TEST**

Note: If this self test fails, all other self tests will fail even if the functionality might be OK.**Run this self test before running all others.**

2 **ST_CDSP_RF_SUPPLY_TEST**

Note: If this self test fails, it might also affect all the following self tests.

3 **ST_CDSP_PLL_PHASE_LOCK_TEST**

Note: If this self test fails, it affects the **RX_IQ_LOOP_BACK** self test.

4 **ST_CDSP_RX_IQ_LOOP_BACK_TEST**

5 **ST_CDSP_PWR_DETECTOR_BIAS_TEST**

Note: If this self test fails, the **GSM_TX_POWER** self test will also fail.

6 **ST_CDSP_GSM_TX_POWER_TEST**

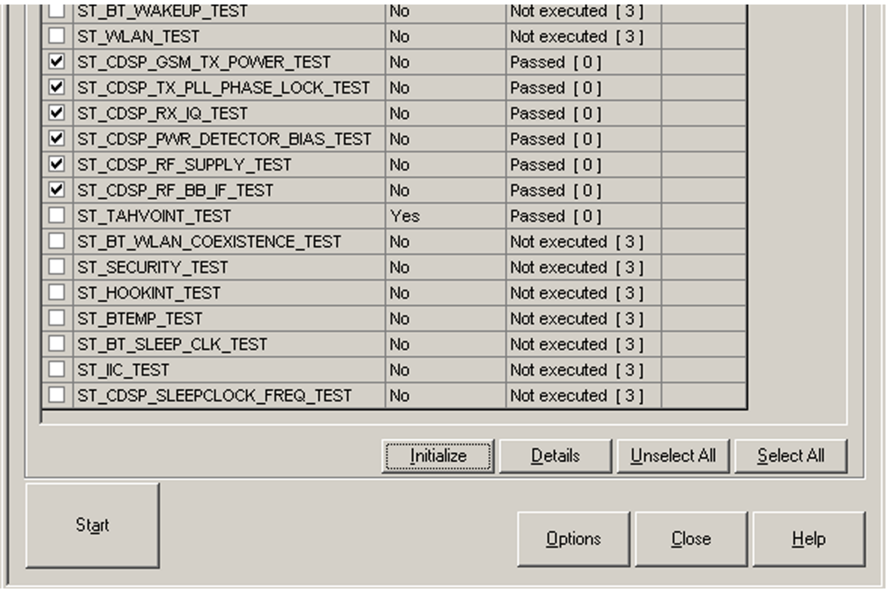
The instructions for running the tests are given below.

Steps

1. Select in Phoenix **Testing→Self Tests** in Phoenix.

   Check the tests shown in the figure below.

   Note: Keep in mind the order in which the self tests should be executed.



☐	ST_BT_WAKEUP_TEST	No	Not executed [3]
☐	ST_WLAN_TEST	No	Not executed [3]
☑	ST_CDSP_GSM_TX_POWER_TEST	No	Passed [0]
☑	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Passed [0]
☑	ST_CDSP_RX_IQ_TEST	No	Passed [0]
☑	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Passed [0]
☑	ST_CDSP_RF_SUPPLY_TEST	No	Passed [0]
☑	ST_CDSP_RF_BB_IF_TEST	No	Passed [0]
☐	ST_TAHVOINT_TEST	Yes	Passed [0]
☐	ST_BT_WLAN_COEXISTENCE_TEST	No	Not executed [3]
☐	ST_SECURITY_TEST	No	Not executed [3]
☐	ST_HOOKINT_TEST	No	Not executed [3]
☐	ST_BTEMP_TEST	No	Not executed [3]
☐	ST_BT_SLEEP_CLK_TEST	No	Not executed [3]
☐	ST_IIC_TEST	No	Not executed [3]
☐	ST_CDSP_SLEEPCLOCK_FREQ_TEST	No	Not executed [3]

2. Click **Details** to see the error codes.

Next actions

If a self test result is fatal, check the error codes from RF self test error codes (page 4–6), and follow the instructions given in RF self test troubleshooting overview (page 4–8).

RF self test error codes

If the result of the **ST_CDSP_RF_BB_IF_TEST** is fatal, the result of all the other self tests will also be fatal. Always start troubleshooting with the **ST_CDSP_RF_BB_IF_TEST**.

ST_CDSP_RF_BB_IF_TEST result is fatal

Error code	Error code	Comment
ST_RFBUS_WRITE_READ_FAIL	(0x0040)	RF bus write/read test failed.

ST_CDSP_RF_SUPPLY_TEST result is fatal

Error code	Error code	Comment
ST_VBAT_OUT_OF_RANGE	(0x0001)	VBat voltage is not within range.

ST_CDSP_PLL_PHASE_LOCK_TEST result is fatal

Error code	Error code	Comment
ST_TX_PLL_FAIL	(0x0008)	Tx PLL test failed.

ST_CDSP_RX_IQ_LOOP_BACK_TEST result is fatal

Error code	Error code	Comment
ST_RX_IQ_TEST_FAILED	(0x0001)	Break in Rx signal chain.

ST_CDSP_PW_DETECTOR_BIAS_TEST result is fatal

Error code	Error code	Comment
ST_PWR_VALUE_OUTSIDE_LIMITS	(0x0004)	Power detector values outside the range.

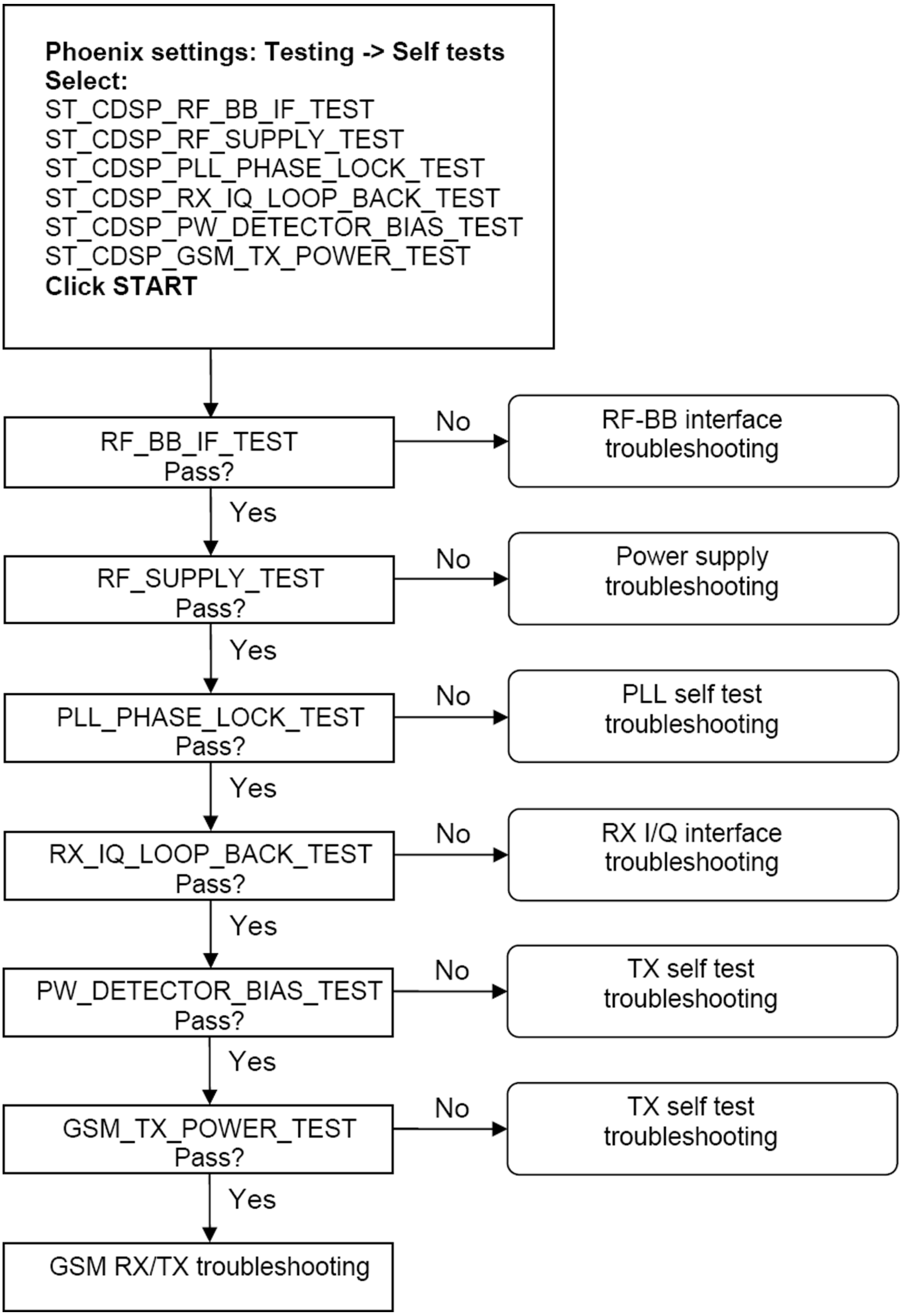
ST_CDSP_GSM_TX_POWER_TEST result is fatal

Error code	Error code	Comment
ST_GSM900_TX_PWR_LOW	(0x0001)	GSM900 Tx power is under threshold.
ST_GSM1800_TX_PWR_LOW	(0x0002)	GSM1800 Tx power is under threshold.
ST_GSM1900_TX_PWR_LOW	(0x0004)	GSM1900 Tx power is under threshold.
ST_GSM850_TX_PWR_LOW	(0x0008)	GSM850 Tx power is under threshold.
ST_GSM900_ADC_OVERFLOW	(0x0010)	GSM900 ADC overflow.
ST_GSM1800_ADC_OVERFLOW	(0x0020)	GSM1800 ADC overflow.
ST_GSM1900_ADC_OVERFLOW	(0x0040)	GSM1900 ADC overflow.
ST_GSM850_ADC_OVERFLOW	(0x0080)	GSM850 ADC overflow.

Troubleshooting with RF self tests

RF self test troubleshooting overview

Troubleshooting flow


Phoenix settings: Testing -> Self tests
Select:
ST_CDSP_RF_BB_IF_TEST
ST_CDSP_RF_SUPPLY_TEST
ST_CDSP_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_PW_DETECTOR_BIAS_TEST
ST_CDSP_GSM_TX_POWER_TEST
Click START
RF_BB_IF_TEST Pass?
No
RF-BB interface troubleshooting
Yes
RF_SUPPLY_TEST Pass?
No
Power supply troubleshooting
Yes
PLL_PHASE_LOCK_TEST Pass?
No
PLL self test troubleshooting
Yes
RX_IQ_LOOP_BACK_TEST Pass?
No
RX I/Q interface troubleshooting
Yes
PW_DETECTOR_BIAS_TEST Pass?
No
TX self test troubleshooting
Yes
GSM_TX_POWER_TEST Pass?
No
TX self test troubleshooting
Yes
GSM RX/TX troubleshooting

RF-BB interface troubleshooting (ST_CDSP_RF_BB_IF_TEST)

Troubleshooting flow

Phoenix settings: Testing -> GSM -> RF Controls
Active Unit = RX
Band = 850 band
Op Mode = Burst
AGC = default

Scope at
RFBusClk (J2804)
Signal = 2.7 V
DC offset = -0.47 V
Freq = 9.6 MHz
RFBusDa (J2805)
Signal = 2.05 V
DC offset = -0.09 V
RFBusEN1x (J2806)
Signal = 2.05 V
DC offset = -0.09 V

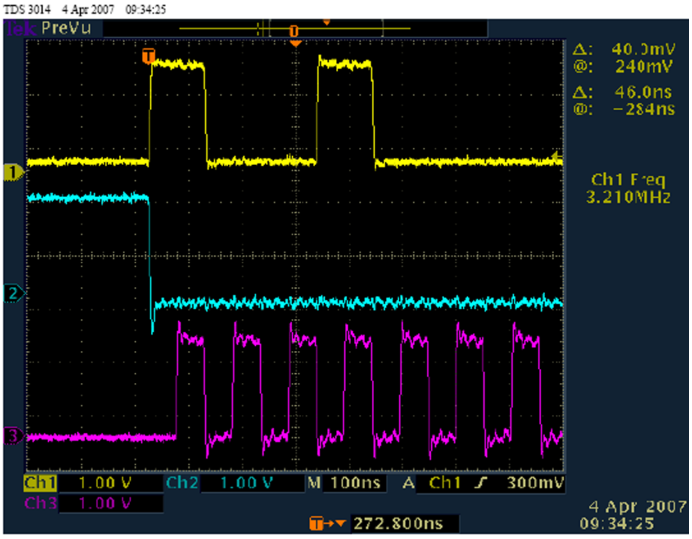
OK?

No

Baseband troubleshooting

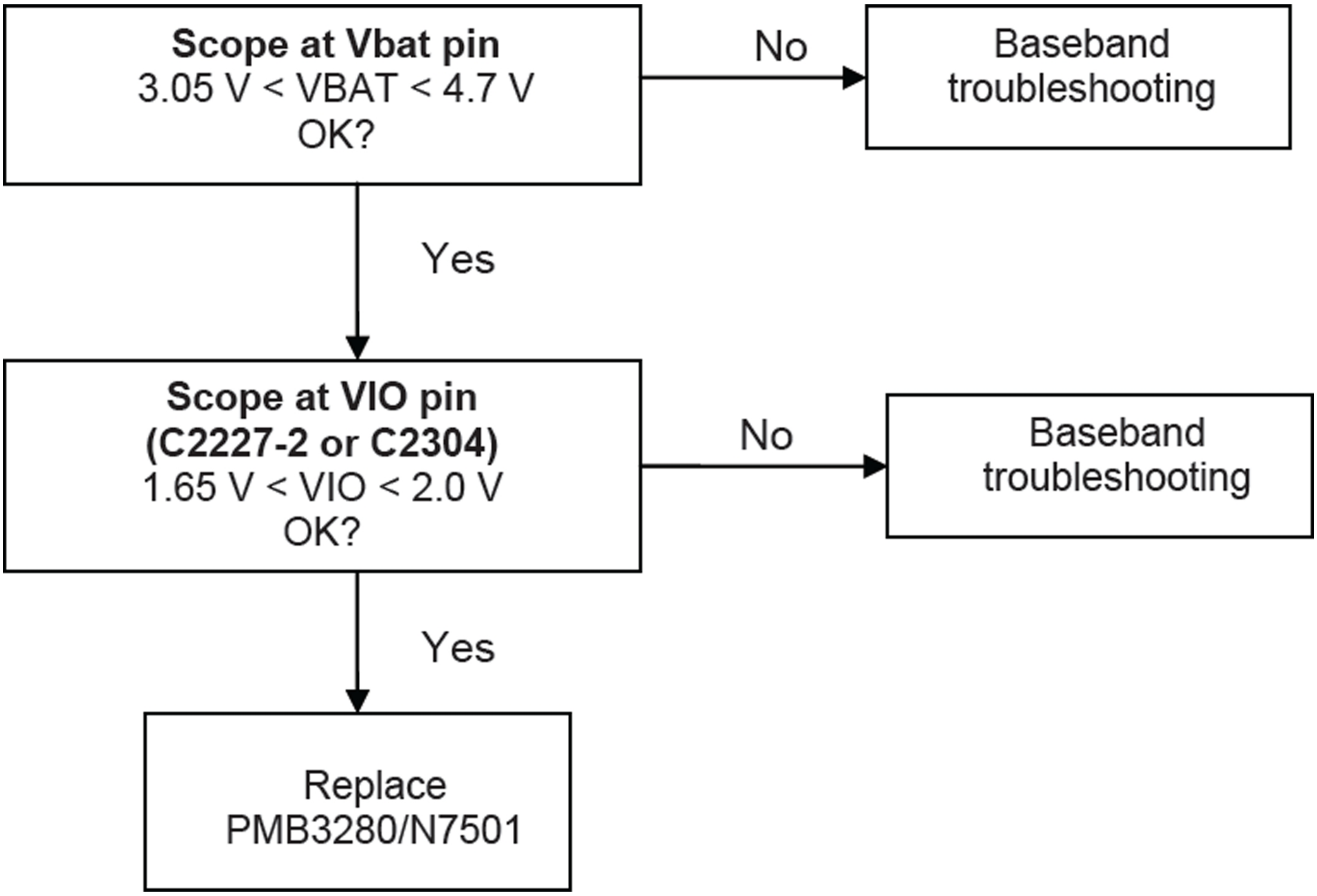
Yes

RF-BB interface failure.
Replace PMB3280


TDS 3014 4 Apr 2007 09:34:25
Tek PreVu
Δ: 40.0mV
@: 240mV
Δ: 46.0ns
@: −284ns
Ch1 Freq
3.210MHz
1
2
3
Ch1 1.00 V
Ch2 1.00 V
M 100ns
A Ch1 ∫ 300mV
Ch3 1.00 V
272.800ns
4 Apr 2007
09:34:25

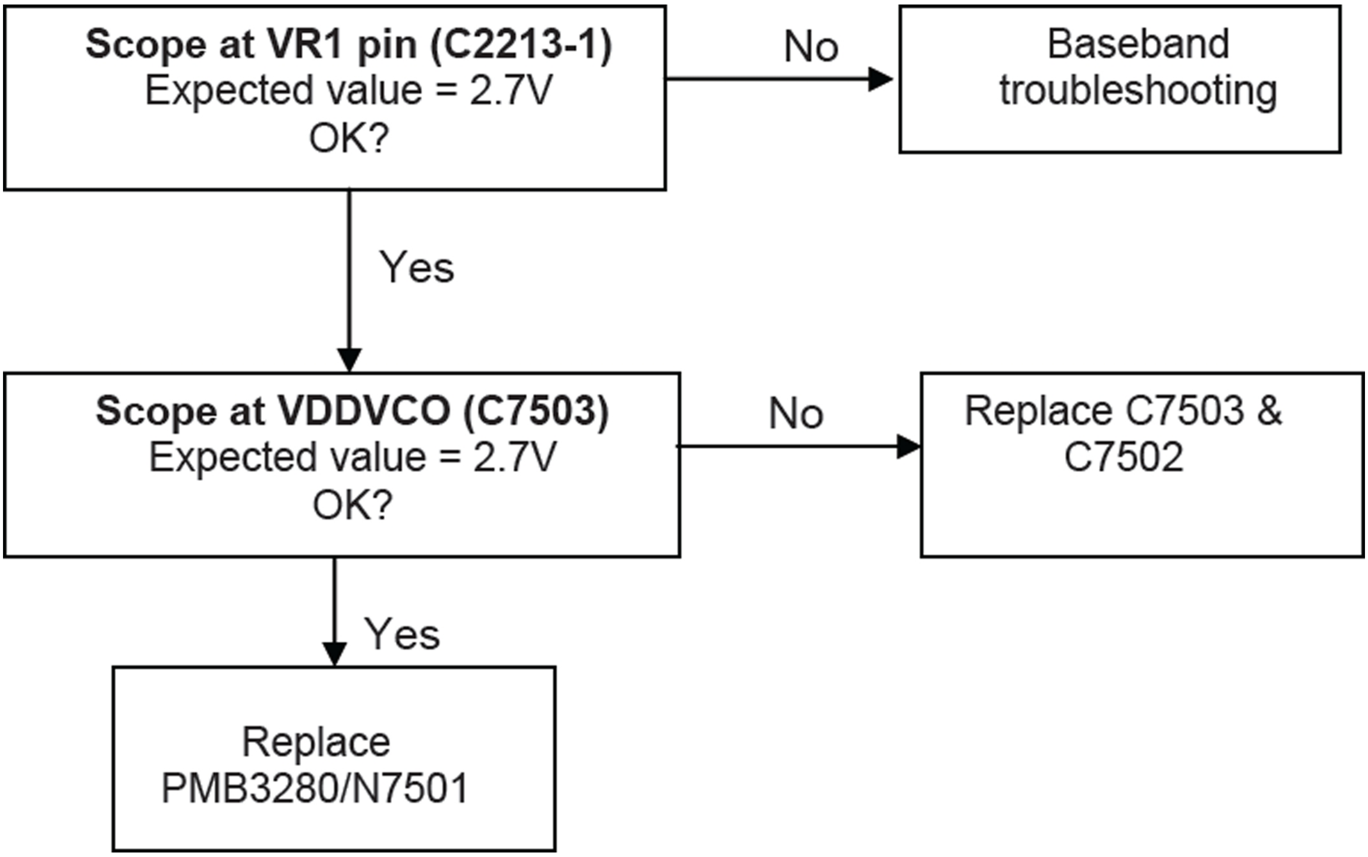
Power supply troubleshooting (ST_CDSP_RF_SUPPLY_TEST)

Troubleshooting flow


Scope at Vbat pin
3.05 V < VBAT < 4.7 V
OK?
No
Baseband troubleshooting
Yes
Scope at VIO pin
(C2227-2 or C2304)
1.65 V < VIO < 2.0 V
OK?
No
Baseband troubleshooting
Yes
Replace PMB3280/N7501

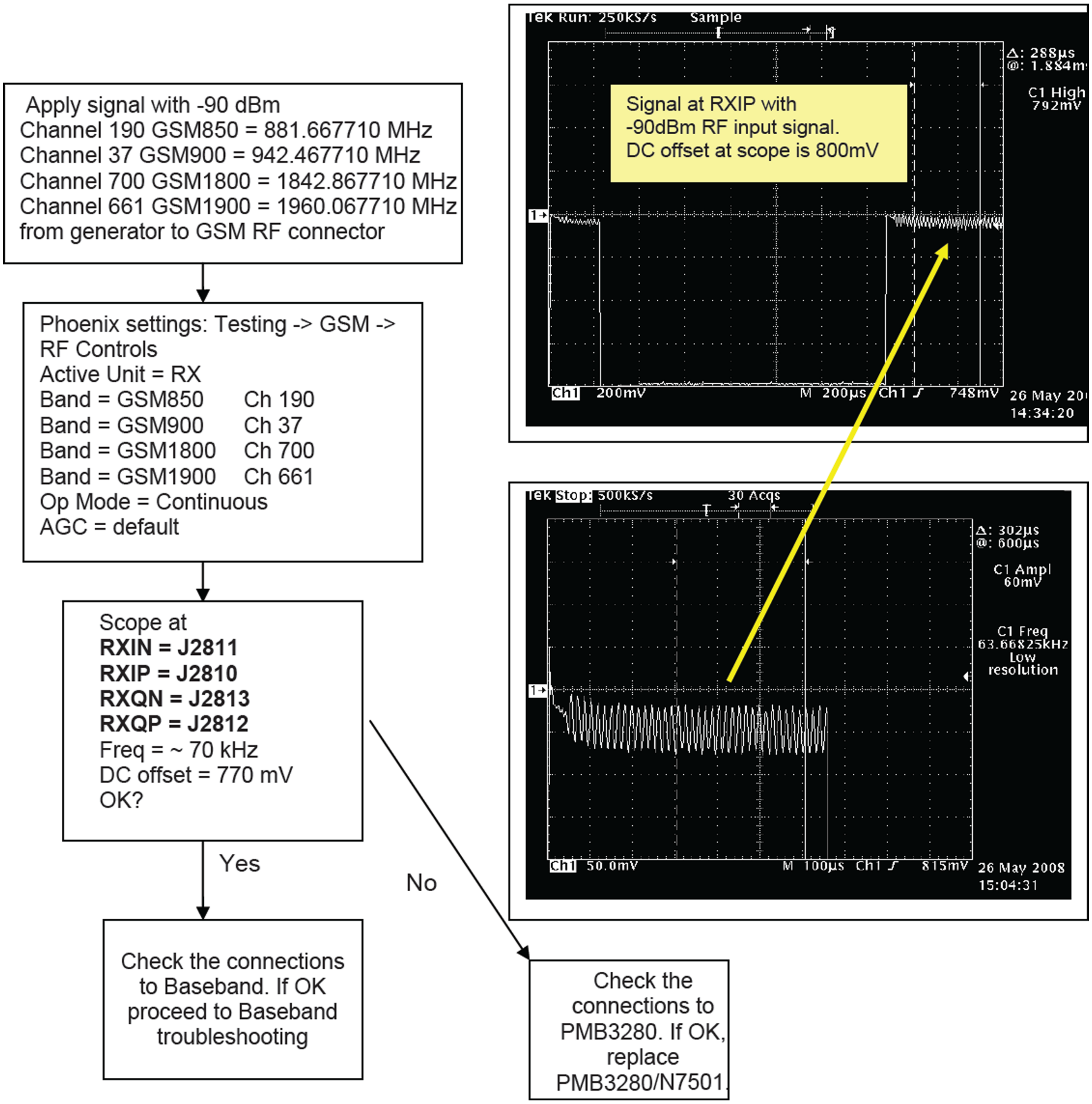
PLL self test troubleshooting (ST_CDSP_PLL_PHASE_LOCK_TEST)

Troubleshooting flow


Scope at VR1 pin (C2213-1)
Expected value = 2.7V
OK?
No
Baseband troubleshooting
Yes
Scope at VDDVCO (C7503)
Expected value = 2.7V
OK?
No
Replace C7503 & C7502
Yes
Replace PMB3280/N7501

RX IQ interface troubleshooting (ST_CDSP_RX_IQ_LOOP_BACK_TEST)

Troubleshooting flow



Apply signal with -90 dBm
Channel 190 GSM850 = 881.667710 MHz
Channel 37 GSM900 = 942.467710 MHz
Channel 700 GSM1800 = 1842.867710 MHz
Channel 661 GSM1900 = 1960.067710 MHz
from generator to GSM RF connector

Phoenix settings: Testing -> GSM -> RF Controls
Active Unit = RX
Band = GSM850 Ch 190
Band = GSM900 Ch 37
Band = GSM1800 Ch 700
Band = GSM1900 Ch 661
Op Mode = Continuous
AGC = default

Scope at
RXIN = J2811
RXIP = J2810
RXQN = J2813
RXQP = J2812
Freq = ~ 70 kHz
DC offset = 770 mV
OK?

Yes: Check the connections to Baseband. If OK proceed to Baseband troubleshooting

No: Check the connections to PMB3280. If OK, replace PMB3280/N7501

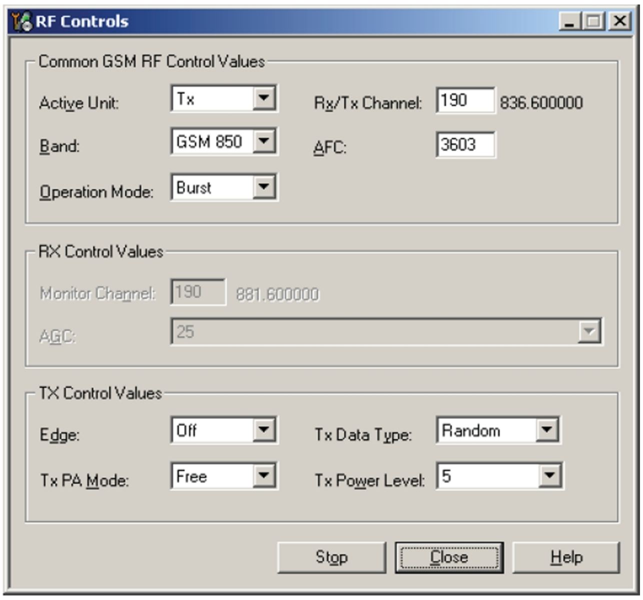
Signal at RXIP with -90dBm RF input signal. DC offset at scope is 800mV

Tek Run: 250kS/s Sample
Δ: 288µs
@: 1.884m
C1 High
792mV
Ch1 200mV M 200µs Ch1 ∫ 748mV
26 May 20
14:34:20
Tek Stop: 500kS/s 30 Acqs
Δ: 302µs
@: 600µs
C1 Ampl
60mV
C1 Freq
63.66825kHz
Low resolution
Ch1 50.0mV M 100µs Ch1 ∫ 815mV
26 May 2008
15:04:31

TX selftest troubleshooting (ST_CDSP_PWR_DETECTOR_BIAS_TEST and ST_CDSP_GSM_TX_POWER_TEST)

Troubleshooting flow

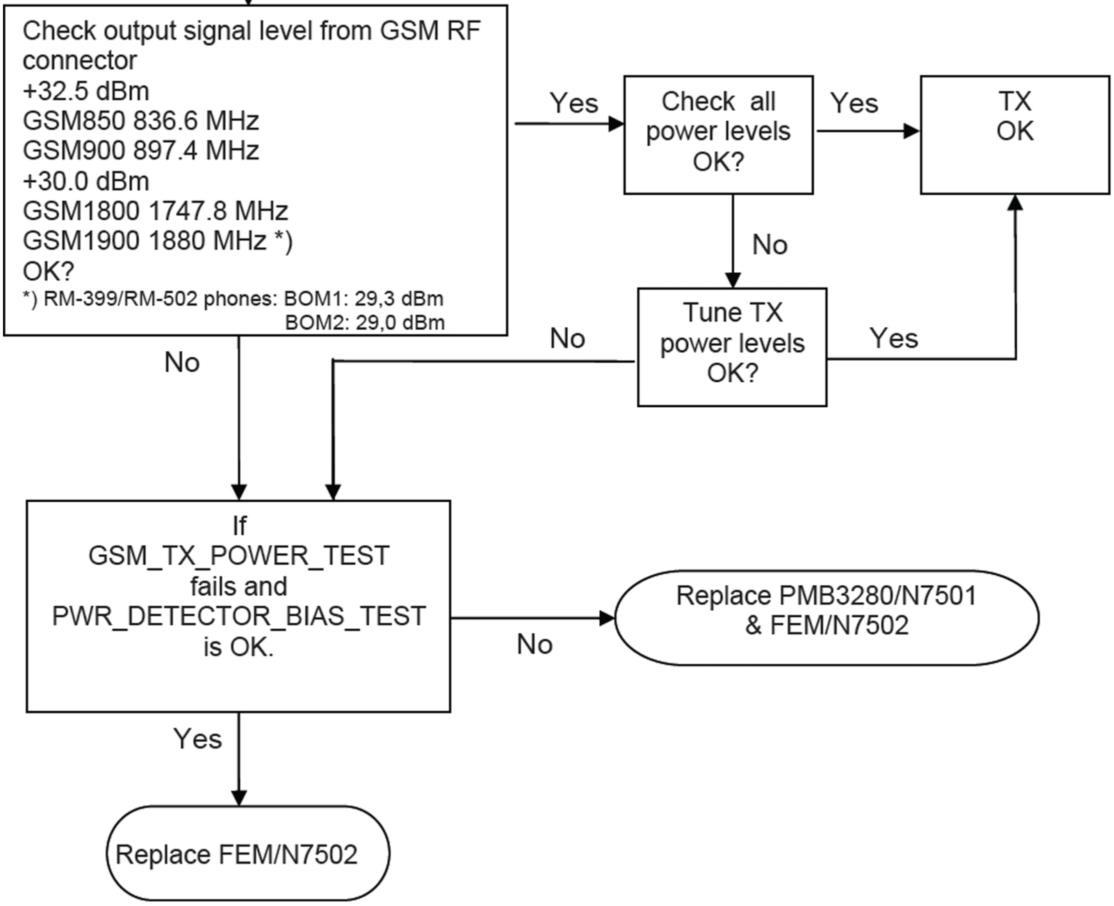
Phoenix settings: Testing -> GSM -> RF Controls
Active Unit = TX
Band = GSM850
Band = GSM900
Band = GSM1800
Band = GSM1900
Op Mode = Burst
AGC = default
TX Channel = 190 GSM850
TX Channel = 37 GSM900
TX Channel = 700 GSM1800
TX Channel = 661 GSM1900
EDGE = Off
TX Data type = Random
Power level = 5 GSM850/900
Power level = 0 GSM1800/1900


RF Controls
Stop
Close
Help

Common GSM RF Control Values
Active Unit: Tx
Rx/Tx Channel: 190 836.600000
Band: GSM 850
AFC: 3603
Operation Mode: Burst

RX Control Values
Monitor Channel: 190 881.600000
AGC: 25

TX Control Values
Edge: Off
Tx Data Type: Random
Tx PA Mode: Free
Tx Power Level: 5


Check output signal level from GSM RF connector
+32.5 dBm
GSM850 836.6 MHz
GSM900 897.4 MHz
+30.0 dBm
GSM1800 1747.8 MHz
GSM1900 1880 MHz *)
OK?
*) RM-399/RM-502 phones: BOM1: 29,3 dBm
BOM2: 29,0 dBm
Yes
Check all power levels OK?
Yes
TX OK
No
Tune TX power levels OK?
Yes
No
No
If GSM_TX_POWER_TEST fails and PWR_DETECTOR_BIAS_TEST is OK.
No
Replace PMB3280/N7501 & FEM/N7502
Yes
Replace FEM/N7502

Receiver troubleshooting

Introduction to RX troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see GSM RX chain activation for manual measurements / GSM RSSI measurement (page 4–14).

GSM RX chain activation for manual measurements/GSM RSSI measurement

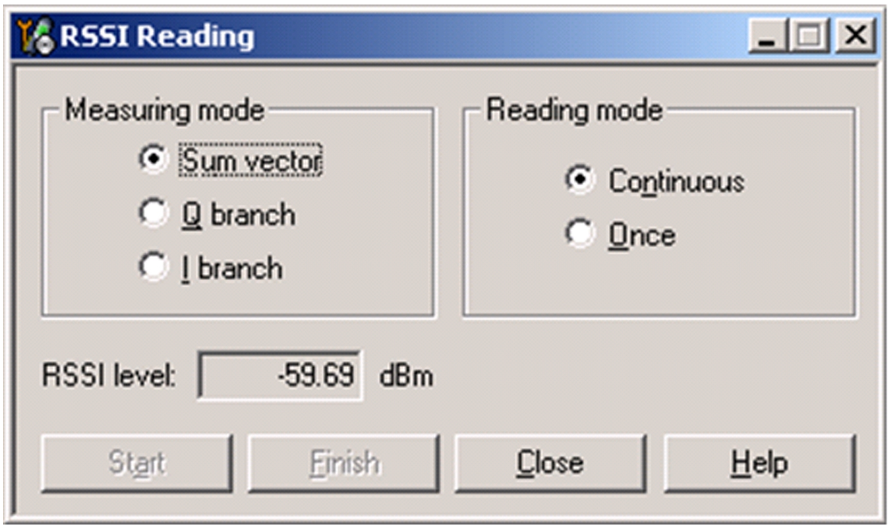
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz (67.71kHz offset) at -60dBm	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -59.69 dBm

Results

The reading should reflect the level of the signal generator (-losses) +/- 1dB.

When varying the level in the range -30 to -102 dBm, the reading should then follow within +/-2 dB.

Transmitter troubleshooting

General instructions for TX troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production.

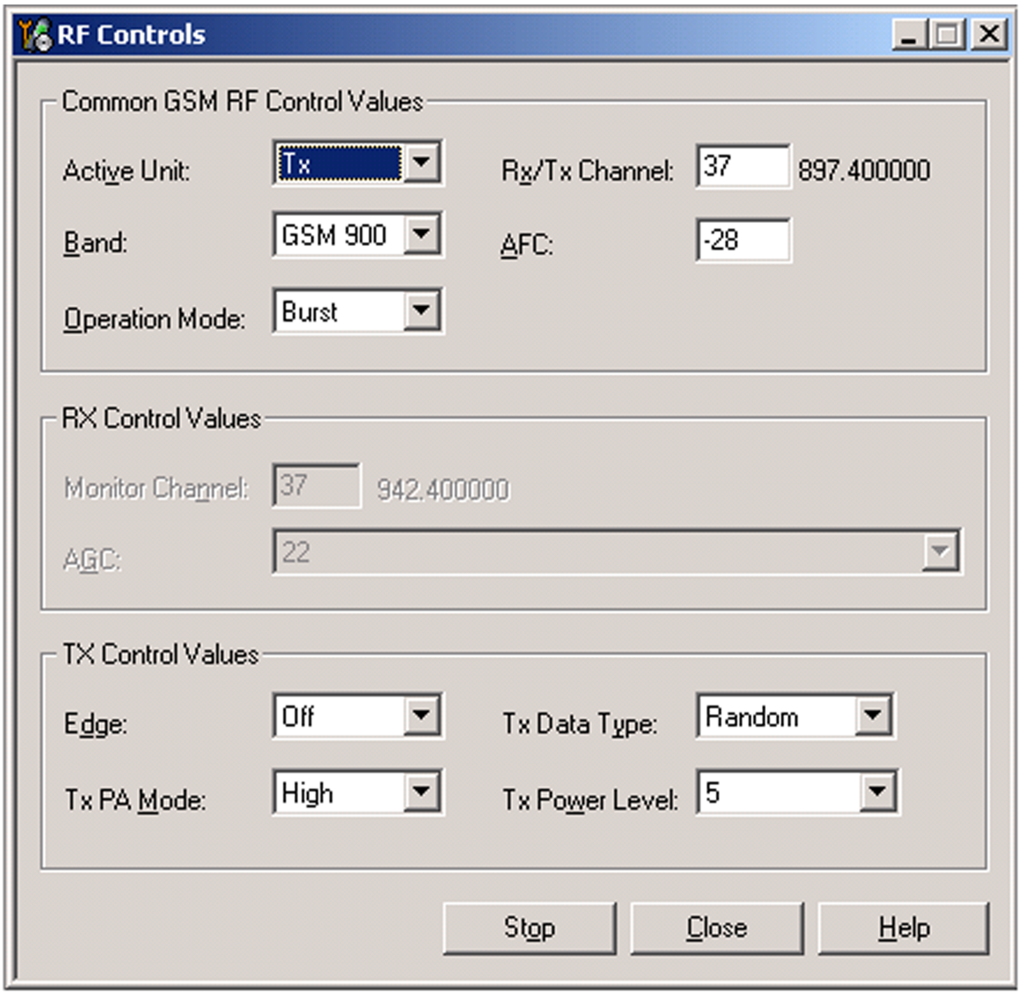
> **Note:** Never activate the GSM transmitter without a proper antenna load. Always connect a 50 Ohm load to the RF connector (antenna, RF measurement equipment or at least a 2 Watt dummy load); otherwise the GSM PA may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

   Use the following settings:



RF Controls

Common GSM RF Control Values

Active Unit: Tx

Rx/Tx Channel: 37 897.400000

Band: GSM 900

AFC: -28

Operation Mode: Burst

RX Control Values

Monitor Channel: 37 942.400000

AGC: 22

TX Control Values

Edge: Off

Tx Data Type: Random

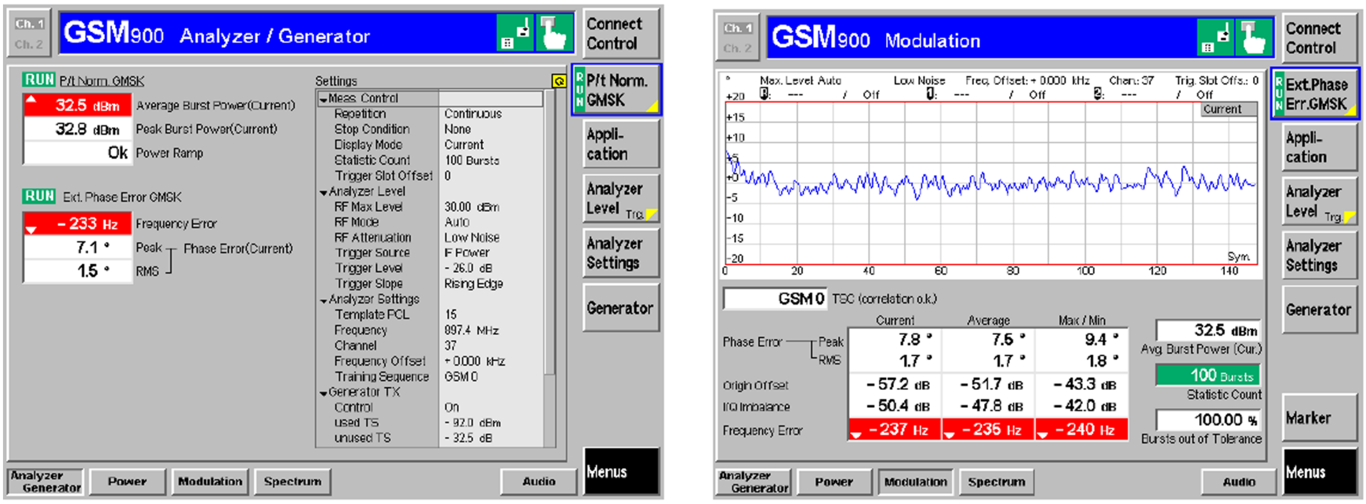
Tx PA Mode: High

Tx Power Level: 5

3. Use a communication analyser (for example CMU200) to check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum).

Analyzer settings:

Phase error:


Ch. 1
Ch. 2
GSM900 Analyzer / Generator
Connect Control
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio
GSM900 Modulation
Max. Level: Auto
Low Noise
Freq. Offset: + 0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
Ext.Phase Err.GMSK
Marker
+20
+15
+10
+5
+0
-5
-10
-15
-20
Sym.
0
20
40
60
80
100
120
140

RUN P/t Norm. GMSK

32.5 dBm	Average Burst Power(Current)
32.8 dBm	Peak Burst Power(Current)
Ok	Power Ramp

RUN Ext. Phase Error GMSK

- 233 Hz	Frequency Error	
7.1 °	Peak	Phase Error(Current)
1.5 °	RMS	

Settings

Meas. Control	
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Trigger Slot Offset	0
Analyzer Level	
RF Max Level	30.00 dBm
RF Mode	Auto
RF Attenuation	Low Noise
Trigger Source	IF Power
Trigger Level	- 26.0 dB
Trigger Slope	Rising Edge
Analyzer Settings	
Template PCL	15
Frequency	897.4 MHz
Channel	37
Frequency Offset	+ 0.000 kHz
Training Sequence	GSM 0
Generator TX	
Control	On
used TS	- 92.0 dBm
unused TS	- 32.5 dB

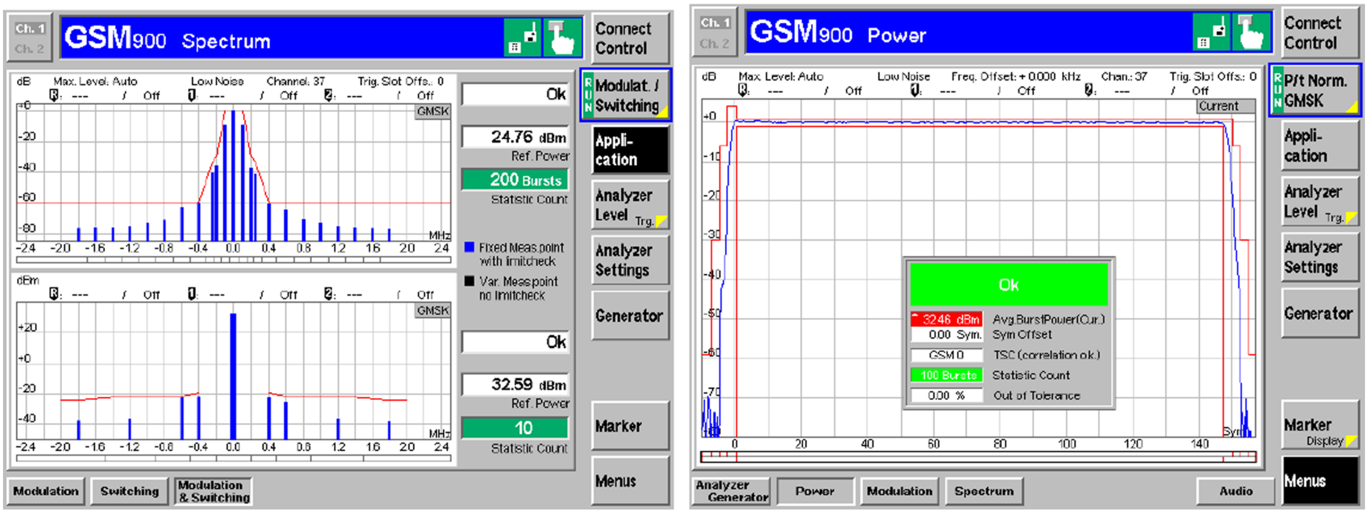
GSM 0 TSC (correlation o.k.)

		Current	Average	Max / Min
Phase Error	Peak	7.8 °	7.5 °	9.4 °
	RMS	1.7 °	1.7 °	1.8 °
Origin Offset		- 57.2 dB	- 51.7 dB	- 43.3 dB
I/Q Imbalance		- 50.4 dB	- 47.8 dB	- 42.0 dB
Frequency Error		- 237 Hz	- 235 Hz	- 240 Hz

32.5 dBm	Avg. Burst Power (Cur.)
100 Bursts	Statistic Count
100.00 %	Bursts out of Tolerance

Modulation-/Switching spectrum:

Power / burst:


Ch. 1
Ch. 2
GSM900 Spectrum
Connect Control
Modulat. / Switching
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator
Marker
Menus
dB
Max. Level: Auto
Low Noise
Channel: 37
Trig. Slot Offs.: 0
Off
GMSK
+0
-20
-40
-60
-80
MHz
-2.4
-2.0
-1.6
-1.2
-0.8
-0.4
0.0
0.4
0.8
1.2
1.6
2.0
2.4
dBm
+20
+0
-20
-40
Modulation
Switching
Modulation & Switching
GSM900 Power
Max. Level: Auto
Low Noise
Freq. Offset: + 0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Current
P/t Norm. GMSK
Marker Display
+0
-10
-20
-30
-40
-50
-60
-70
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

Ok	
24.76 dBm	Ref. Power
200 Bursts	Statistic Count
Ok	
32.59 dBm	Ref. Power
10	Statistic Count

- ■ Fixed Meas.point with limitcheck
- ■ Var. Meas.point no limitcheck

Ok

32.46 dBm	Avg.BurstPower(Cur.)
0.00 Sym.	Sym Offset
GSM 0	TSC (correlation o.k.)
100 Bursts	Statistic Count
0.00 %	Out of Tolerance

Figure 23 Typical readings

4. Change the power level (RF controls) and make sure the power reading follows accordingly.

Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM850, GSM1800 or GSM1900, change the band with the RF controls and set the communication analyser accordingly.

Checking antenna functionality

Antenna overview

The RM-398 has a main GSM antenna and a BT antenna. The RM-399 has a main GSM antenna and a BT/WLAN antenna.

The main antenna has an antenna radiator/flex and antenna deco label.

The BT/WLAN antenna clip is attached to the PWB.

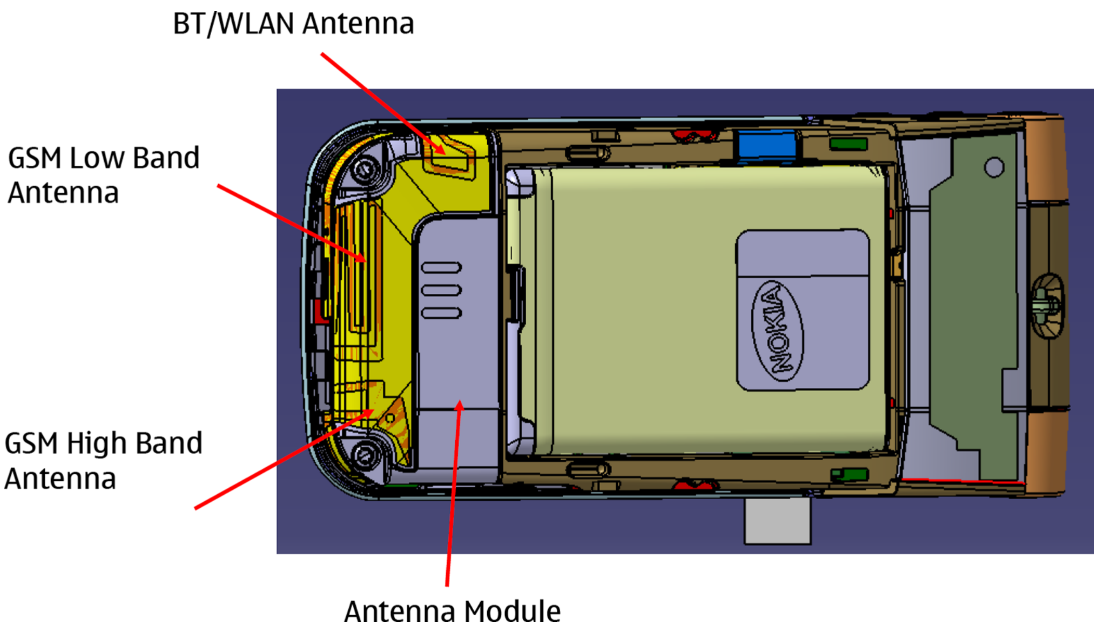

BT/WLAN Antenna
GSM Low Band Antenna
GSM High Band Antenna
Antenna Module

Figure 24 Antenna locations

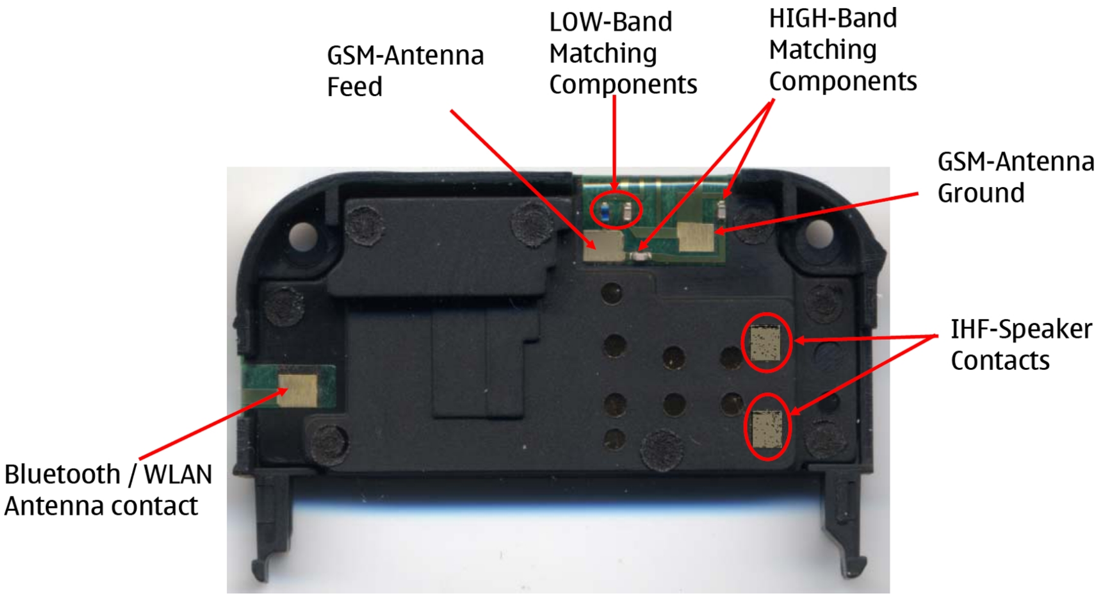

GSM-Antenna Feed
LOW-Band Matching Components
HIGH-Band Matching Components
GSM-Antenna Ground
IHF-Speaker Contacts
Bluetooth / WLAN Antenna contact

Figure 25 Antenna components and contacts

Main antenna functionality

The main GSM antenna is functioning normally when the antenna module assembly is visually intact in the D-cover and PWB, and the antenna radiator/flex and antenna deco label are visually intact in the antenna module assembly.

The main antenna functionality must also be checked by measuring the transmitted power with RF coupler at:

- GSM850 channel 251
- GSM900 channel 124
- GSM1800 channel 885
- GSM1900 channel 810

BT/WLAN antenna functionality

The BT/WLAN antenna is functioning normally when the antenna spring clip takes proper contact to PWB.

RF auto-tuning

This phone has to be tuned automatically by using auto-tuning in Phoenix.

Auto-tuning is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file.

Hardware setup for auto-tuning

- PC (Windows XP) with GPIB card
- Power supply
- Product specific module jig (MJ-172)
- Cables: RF cable + additional product-specific Murata RF probe (MXHS83QE1000), USB cable, GBIP cable and DAU-9S cable
- Smart Card Reader with Super Dongle: SX-4 (connected to the PC)
- Radio Communication Tester (R&S CMU200 or Willtec) or separate RF signal analyser, RF signal generator and RF splitter.

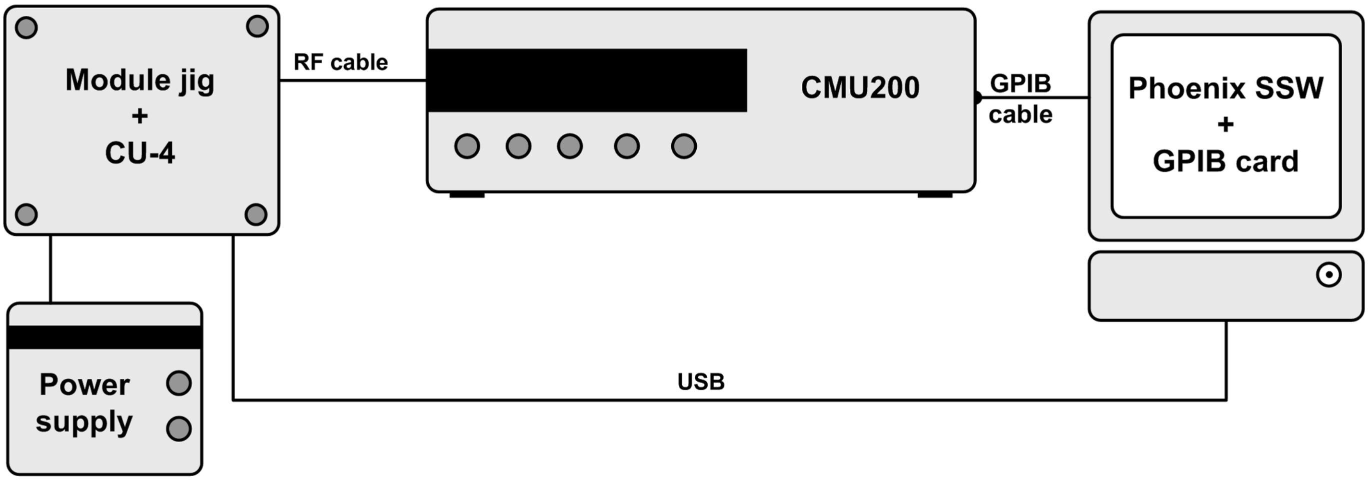


Figure 26 Auto-tuning concept with CMU200

Phoenix preparations

Install the phone-specific data package. This defines the phone-specific settings.

Auto-tuning procedure

1. Make sure the phone (in the jig) is connected to the equipment and product detected in Phoenix.
2. Select **Auto-Tune** from the **Tuning** menu.
3. Ensure that the correct cable attenuations are set in SetLoss feature, accessible in the **Tuning** menu with higher CCS dongles (not with PKD-1).
4. Click the *Tune* button to start auto-tuning.

5 — System Module

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Introduction

Phone description

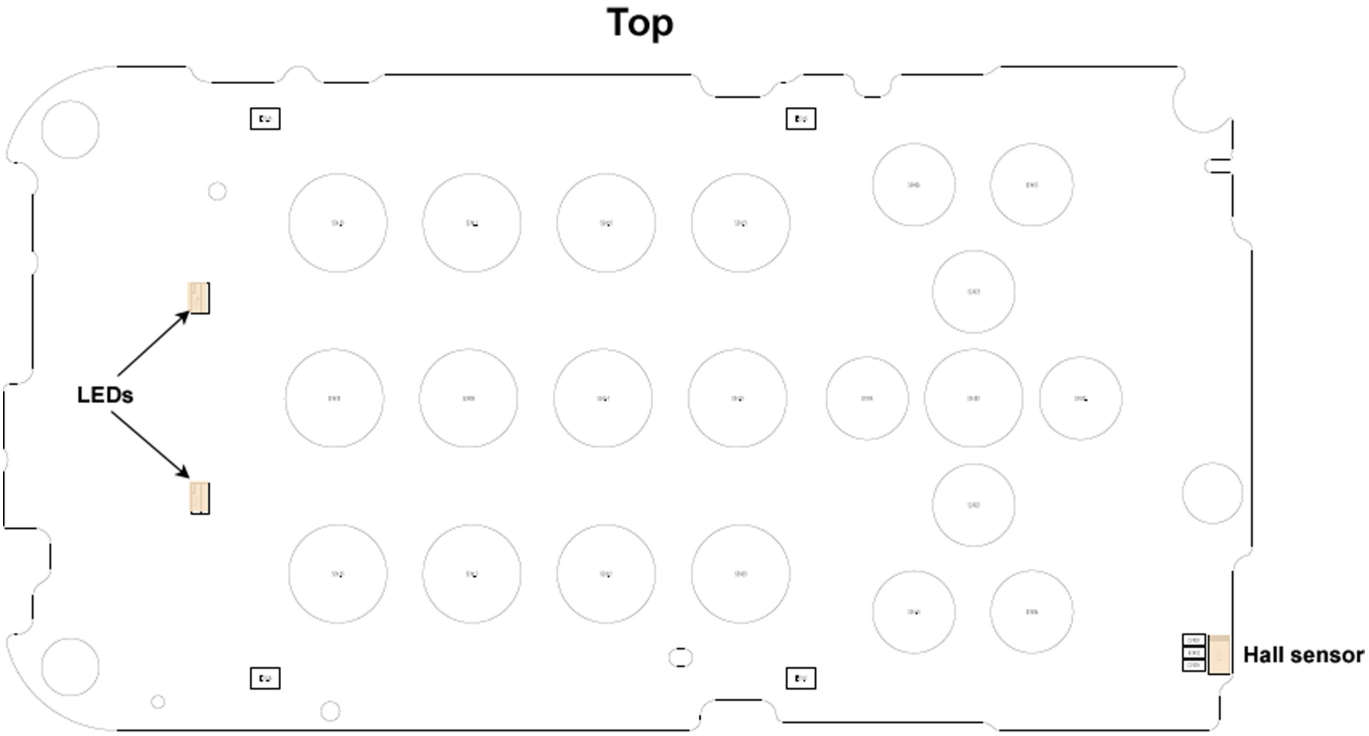
RAP is the main digital baseband ASIC in the phone. It contains functionality for the GSM EDGE. The hardware accelerator is used as a camera accelerator.

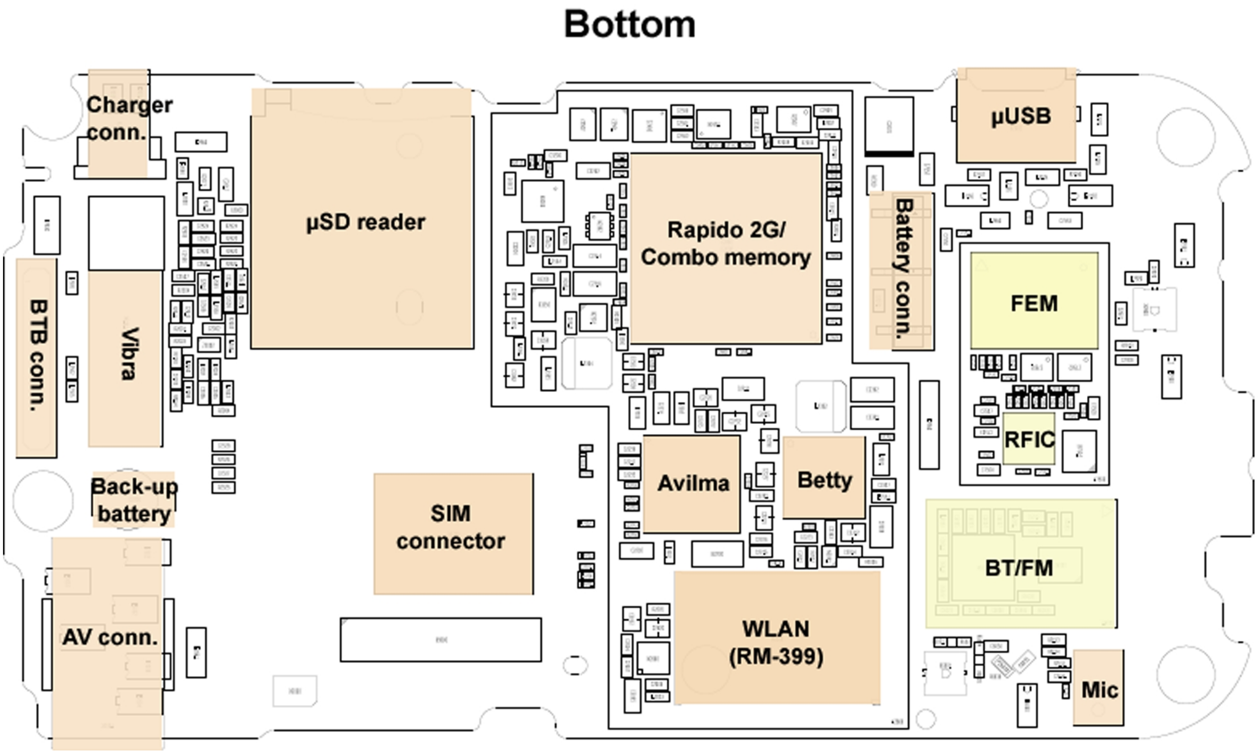
N2200 (AVILMA) is mainly the audio ASIC in the phone and N2300 (BETTY) is basically the energy management controller for the phone.

Key components

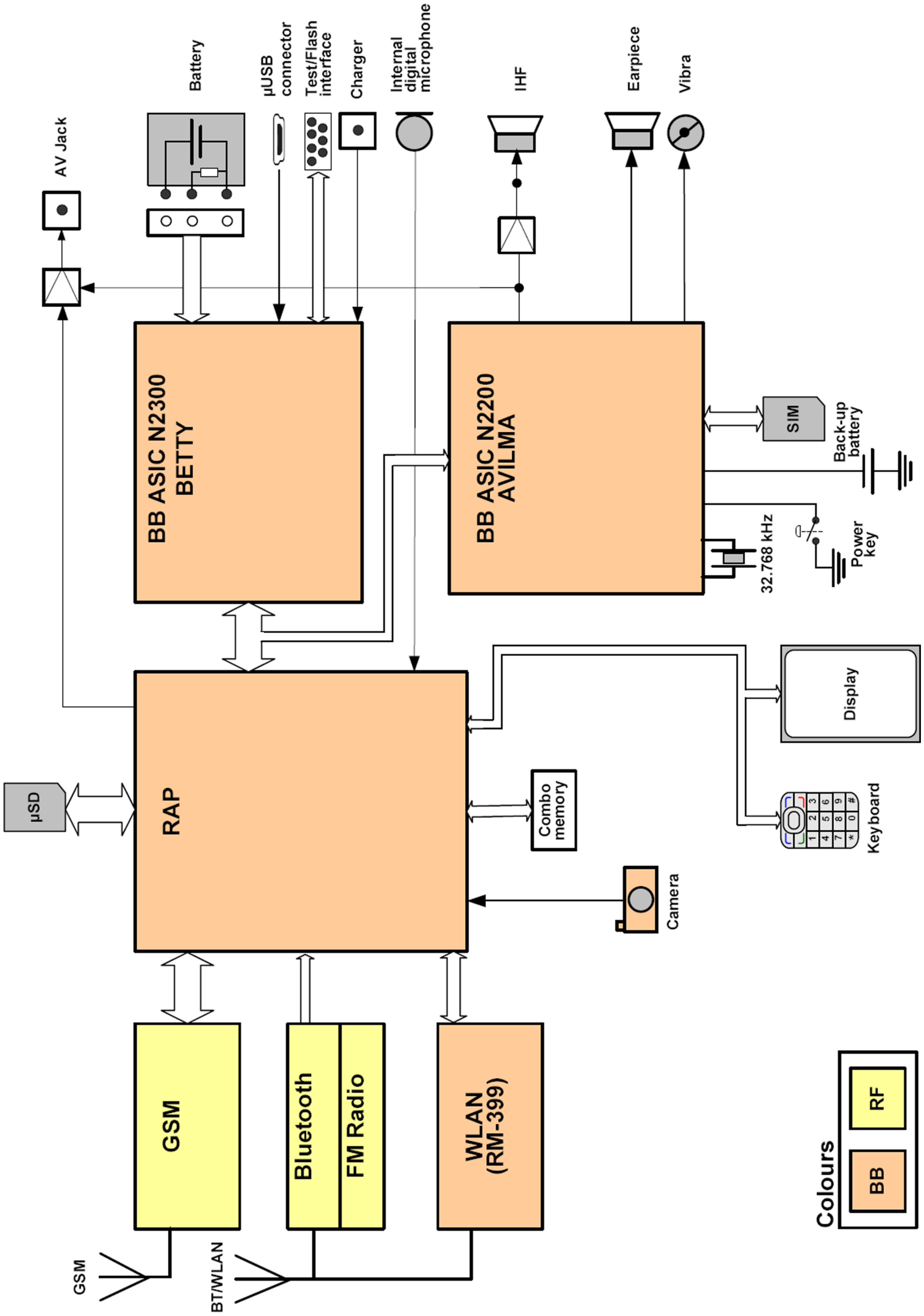
Function	Description	Item ref
Main board	2LWA	
UI flex	2LXA	
Board to board connector	2LZA	
Energy management ASIC	AVILMA BETTY	N2200 N2300
RF ASIC	RF IC	N7501
Processor	RAPIDO 2G	D2800
PA GSM	Front end module (FEM), quad band	N7502
Memory	512 Mbit NOR + 256 Mbit DRAM Combo (Stacked with RAP)	D3000
Bluetooth	BTHFMRDS2.0	N6000
Battery	BL-5BT 860 mAh	
Battery connector	Tabby interface	X2070
µUSB connector	For data, charging and audio	X2002
WLAN (RM-399)	WLAN size 4.0	N6300

Key component placement

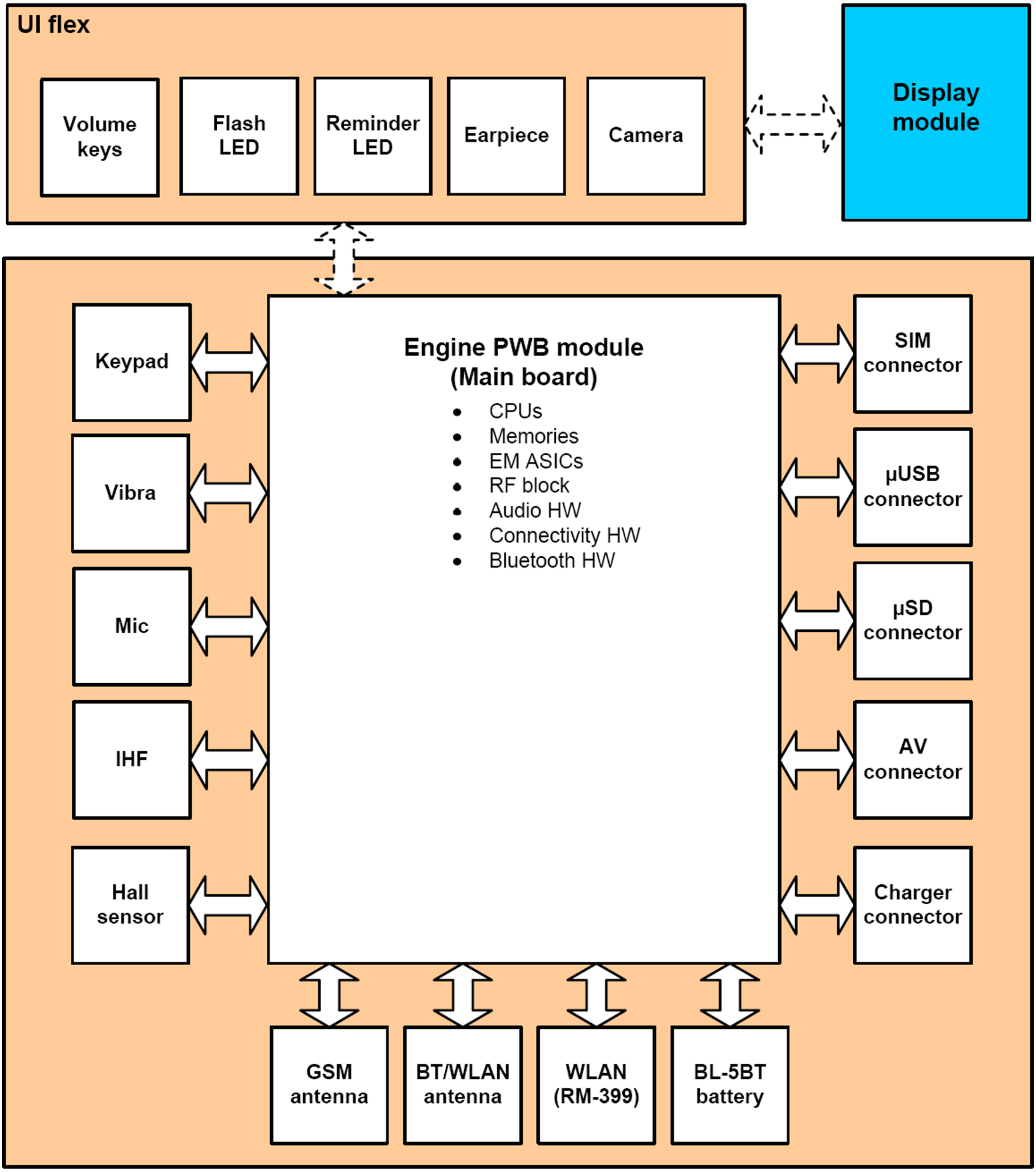

Top
LEDs
Hall sensor


Bottom
Charger conn.
µSD reader
Rapido 2G/ Combo memory
µUSB
Battery conn.
FEM
BTB conn.
Vibra
RFIC
Avilma
Betty
Back-up battery
SIM connector
BT/FM
AV conn.
WLAN (RM-399)
Mic

System module block diagram


AV Jack
Battery
µUSB connector
Test/Flash interface
Charger
Internal digital microphone
IHF
Earpiece
Vibra
BB ASIC N2300 BETTY
BB ASIC N2200 AVILMA
SIM
Back-up battery
32.768 kHz
Power key
Display
Keyboard
µSD
RAP
Combo memory
Camera
GSM
Bluetooth
FM Radio
WLAN (RM-399)
GSM
BT/WLAN
Colours
BB
RF

Board and module connections


UI flex
Volume keys
Flash LED
Reminder LED
Earpiece
Camera
Display module
Engine PWB module (Main board)
CPUs
Memories
EM ASICs
RF block
Audio HW
Connectivity HW
Bluetooth HW
Keypad
Vibra
Mic
IHF
Hall sensor
SIM connector
µUSB connector
µSD connector
AV connector
Charger connector
GSM antenna
BT/WLAN antenna
WLAN (RM-399)
BL-5BT battery

■ Energy management

Battery interface

- Type: BL-5BT

- Technology: Li-Ion, 4.2 V charging, 3.1 V cut-off
- Capacity: 870 mAh.

BL-5BT has a 3 pin interface with overcharge / discharge protection (safety circuit) and battery size indication BSI with an internal resistor. The BSI fixed resistor value indicates type and default capacity of a battery.

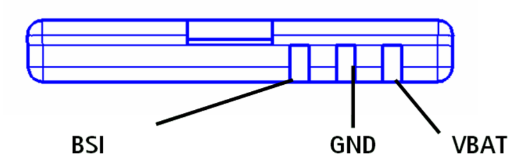


Figure 27 BL-5BT battery pack contacts

Table 11 Pin numbering of battery pack

Signal name	Pin number	Function
GND	2	Negative/common battery terminal
BSI	3	Battery capacity measurement (fixed resistor inside the battery pack)
VBAT	1	Positive battery terminal

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) N2300 BETTY and N2200 AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-5BT battery is used.

Table 12 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	4.1	
Lower extreme voltage	3.5	ADC settings in the SW might shutdown the phone above this value.
Higher extreme voltage (fast charging)	4.2	During fast charging of an empty battery, this voltage might exceed this value. Voltages between 4.20 and 4.60 might appear for a short while.
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		

Voltage	Voltage [V]	Condition
Sw shutdown	3.06*	In call *) ADC settings in the SW might disable the call above this value.
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

This device has a combined *power on and end key*. When the battery is placed in the phone, the key circuits are energized. When the *power on and end key* is pressed, the system boots up (if an adequate battery voltage is present). Power down can be initiated by pressing the key again (the system is powered down with the aid of SW). Short presses are recognized as *end key* presses, while long presses are recognized as *power on key* presses by SW.

The power on and end key is directly connected to the PWRONX pin of the EM ASIC N2200 (AVILMA) via the PWRONX signal.

Table 13 Power on and end key

PWRONX	0	Key pressed
	1	Key not pressed

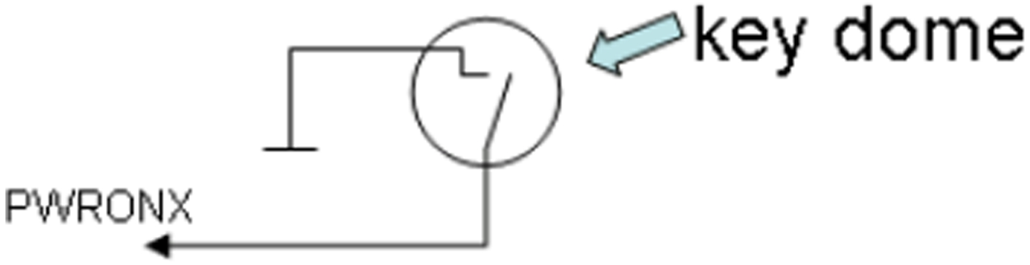


Figure 28 PWRONX signal

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).

Mode	Description
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Connectivity

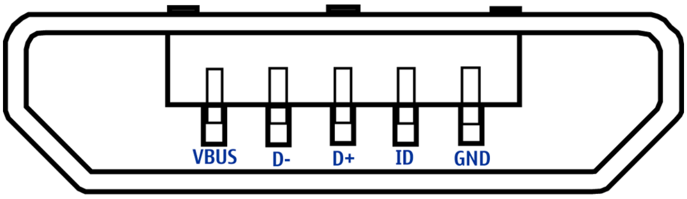
Micro USB interface

The micro USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for µUSB.


VBUS
D-
D+
ID
GND

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC AVILMA (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

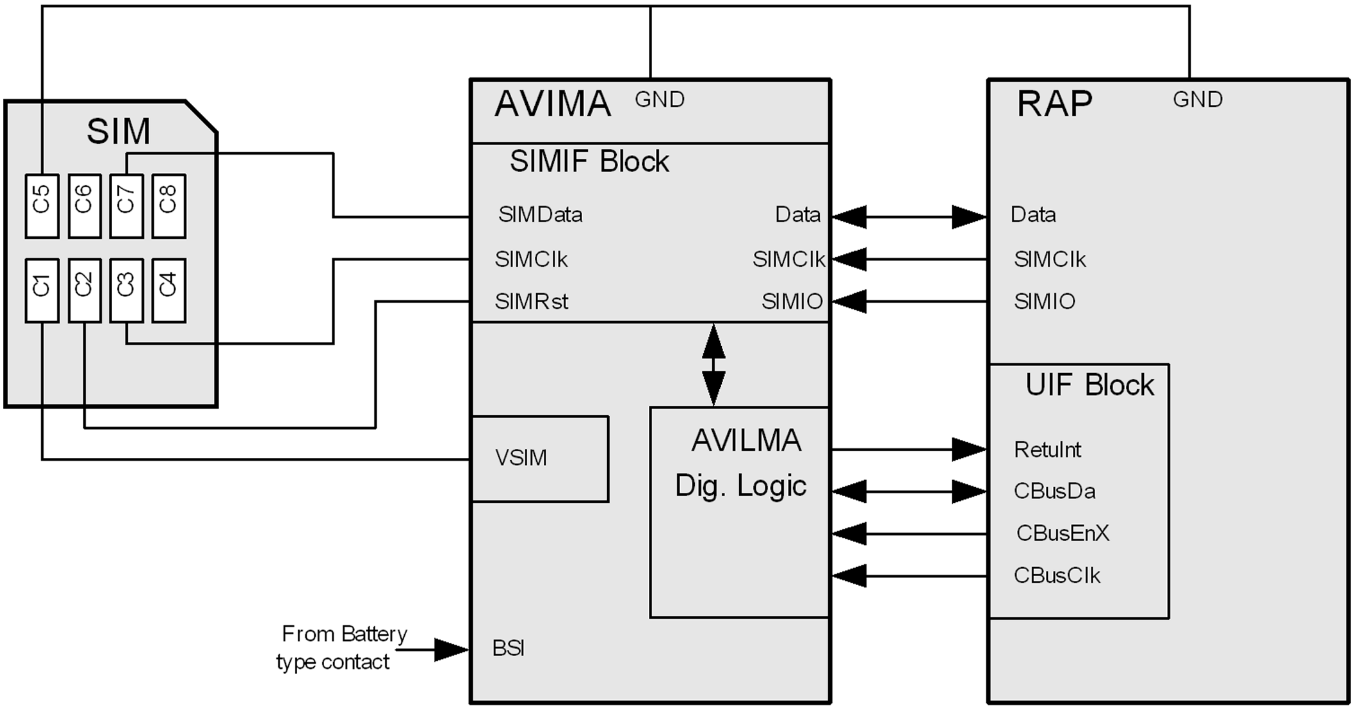

SIM
C5
C6
C7
C8
C1
C2
C3
C4
AVIMA
GND
SIMIF Block
SIMData
SIMClk
SIMRst
Data
SIMClk
SIMIO
VSIM
AVILMA
Dig. Logic
From Battery
type contact
BSI
RAP
GND
Data
SIMClk
SIMIO
UIF Block
RetuInt
CBusDa
CBusEnX
CBusClk

Figure 29 SIM interface

The EM ASIC AVILMA handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM interface.

The SIM interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

MicroSD card interface

The microSD card is connected to the engine via an external level shifter to adapt the 1.8V I/O IF of the RAPS to the 3V IF of the SD IF. The level shifter is a so called integrated level shifter as it additionally contains a 3V LDO to supply the microSD card and components for the ESD/EMC protection of the interface.

RM-398/399 supports high capacity microSD cards (densities up to 32GB).

The card removal is detected by a push detect switch.

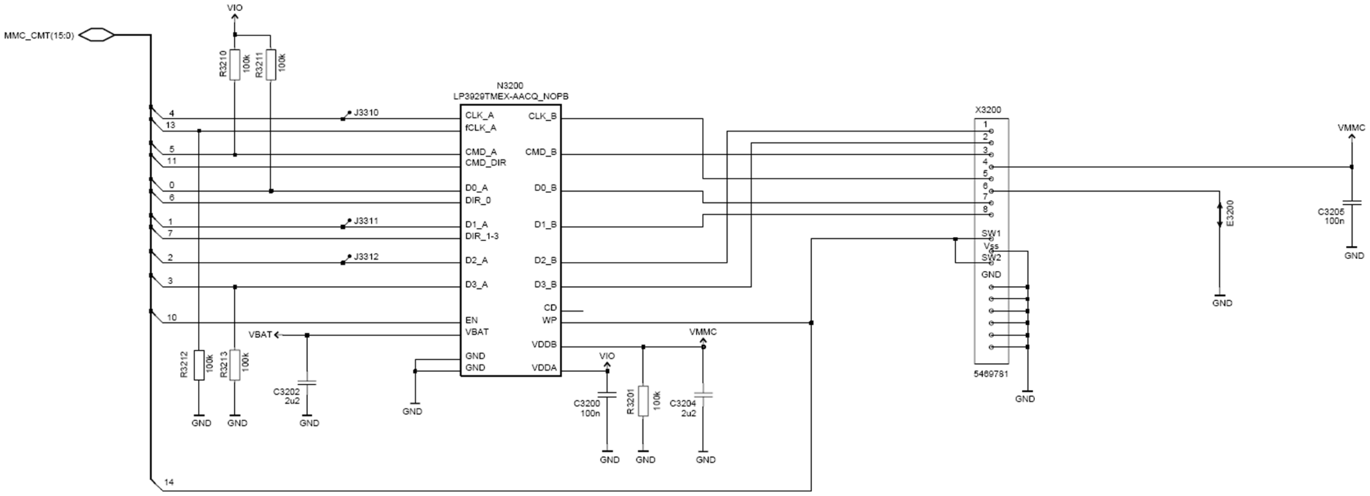

MMC_CMT(15:0)
VIO
R3210
100k
R3211
100k
N3200
LP3929TMEX-AACQ_NOPB
4
13
5
11
0
6
1
7
2
3
10
14
J3310
J3311
J3312
CLK_A
fCLK_A
CMD_A
CMD_DIR
D0_A
DIR_0
D1_A
DIR_1-3
D2_A
D3_A
EN
VBAT
GND
GND
CLK_B
CMD_B
D0_B
D1_B
D2_B
D3_B
CD
WP
VDDB
VDDA
VBAT
R3212
100k
R3213
100k
C3202
2u2
GND
VIO
VMMC
C3200
100n
R3201
100k
C3204
2u2
X3200
1
2
3
4
5
6
7
8
SW1
Vss
SW2
GND
5469781
E3200
VMMC
C3205
100n

Figure 30 MicroSD card engine interface

Charger interface

The charger interface is a 2mm Dynamo charger plug. Older chargers with a 3.5mm plug are supported via the charger adapter cable CA-44.

Charging is controlled by BETTY. Additional external components are needed for EMC purposes, reverse polarity and transient protection of the input to the baseband module.

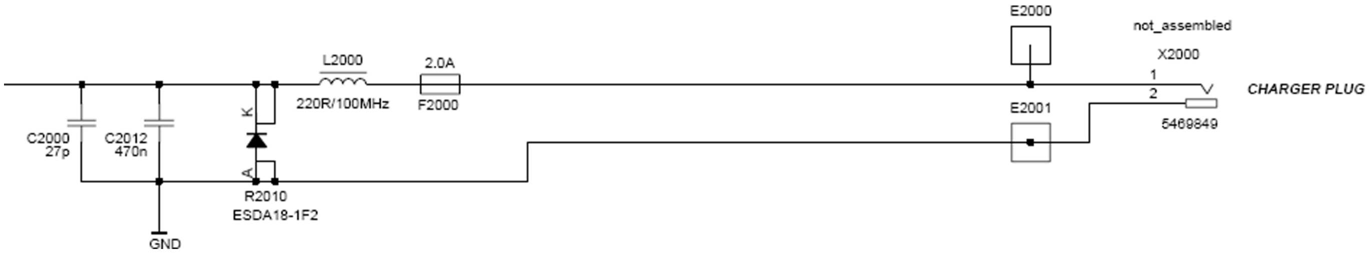

E2000
not_assembled
X2000
1
2
CHARGER PLUG
5469849
E2001
L2000
220R/100MHz
2.0A
F2000
K
A
R2010
ESDA18-1F2
C2000
27p
C2012
470n
GND

Figure 31 Charger interface

AV connector

The 2.5mm AV connector consists of mono or stereo audio output, mono audio input and optional features like control data over microphone line.

A connected male connector is detected on pin 6 (PLUG_DET).

Accessories are detected as basic headset (no ECI) or as intelligent ECI communication devices.

Note: Only use an approved cable for connecting to the AV connector (e.g. headset HS-47).

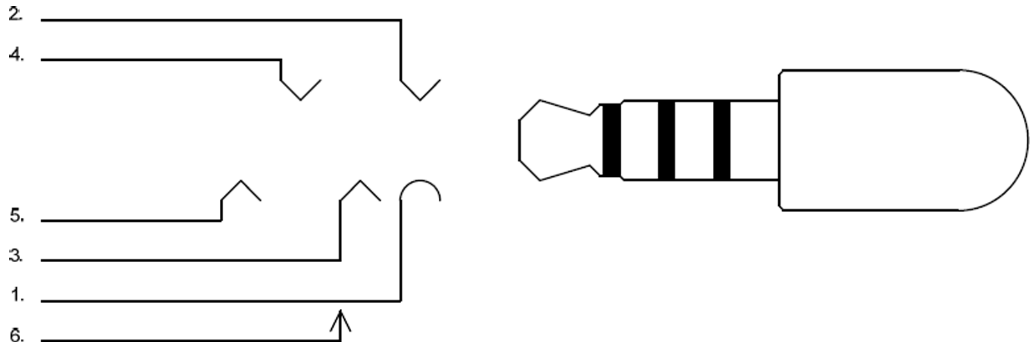


Figure 32 AV connector pin layout

Table 14 AV connector pins

Pin	Signal name	Direction	Description
1, 2	HS_ GND	-	Ground contacts
3	HS_MIC	Input	Multiplexed microphone audio and control data/muxed: MIC2P and ACI, control: GenIO34
4	HS_EAR_R	Output	Audio output (XEAR_R)
5	HS_EAR_L	Output	Audio output (XEAR_L)
6	PLUG_DET	Input	Terminal internal connection, plug detection/ GenIO 33

Bluetooth

The Bluetooth used in this device supports the Bluetooth specification 2.0 and EDR packet types. It is designed to be used in standard HCI UART applications, as well as H4+ UART extensions.

The Bluetooth is physically integrated with the FM radio into a discrete module (N6000).

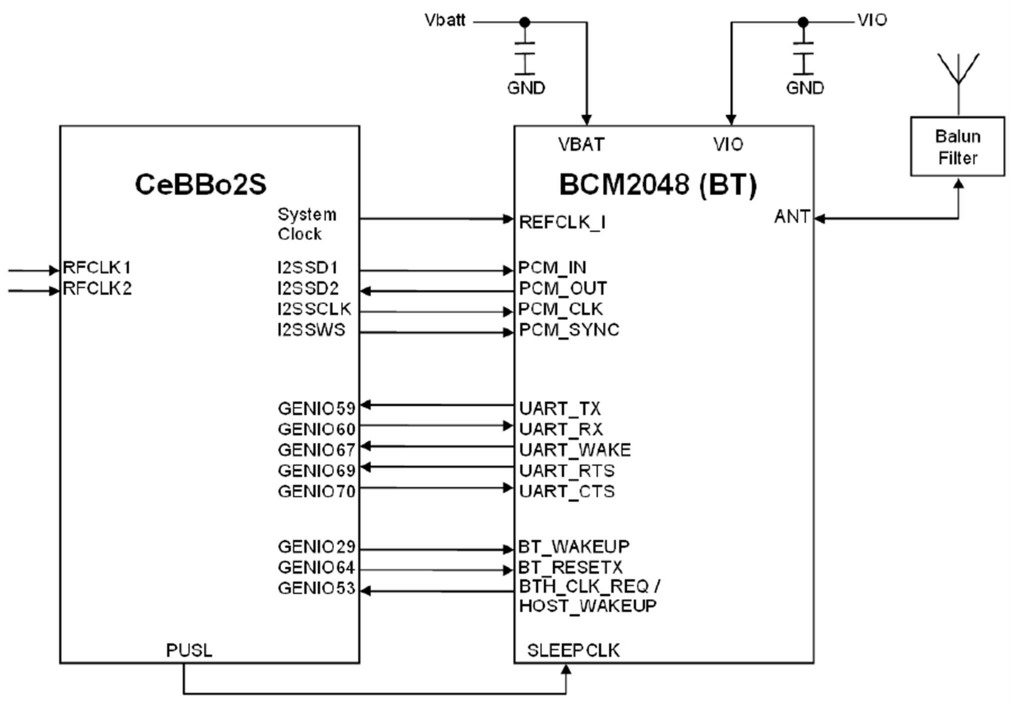

Vbatt
GND
VIO
GND
Balun Filter
VBAT
VIO
CeBBo2S
BCM2048 (BT)
System Clock
REFCLK_I
ANT
RFCLK1
RFCLK2
I2SSD1
I2SSD2
I2SSCLK
I2SSWS
PCM_IN
PCM_OUT
PCM_CLK
PCM_SYNC
GENIO59
GENIO60
GENIO67
GENIO69
GENIO70
UART_TX
UART_RX
UART_WAKE
UART_RTS
UART_CTS
GENIO29
GENIO64
GENIO53
BT_WAKEUP
BT_RESETX
BTH_CLK_REQ / HOST_WAKEUP
PUSL
SLEEPCLK

Figure 33 Bluetooth interface

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/ transmitter) is used for data communication and controls.

FM radio

The FM radio supports 76 MHz to 108 MHz FM Bands (US /Europe), and RDS/RBDS compatibility. The FM radio is physically integrated with the Bluetooth into one single module (N6000).

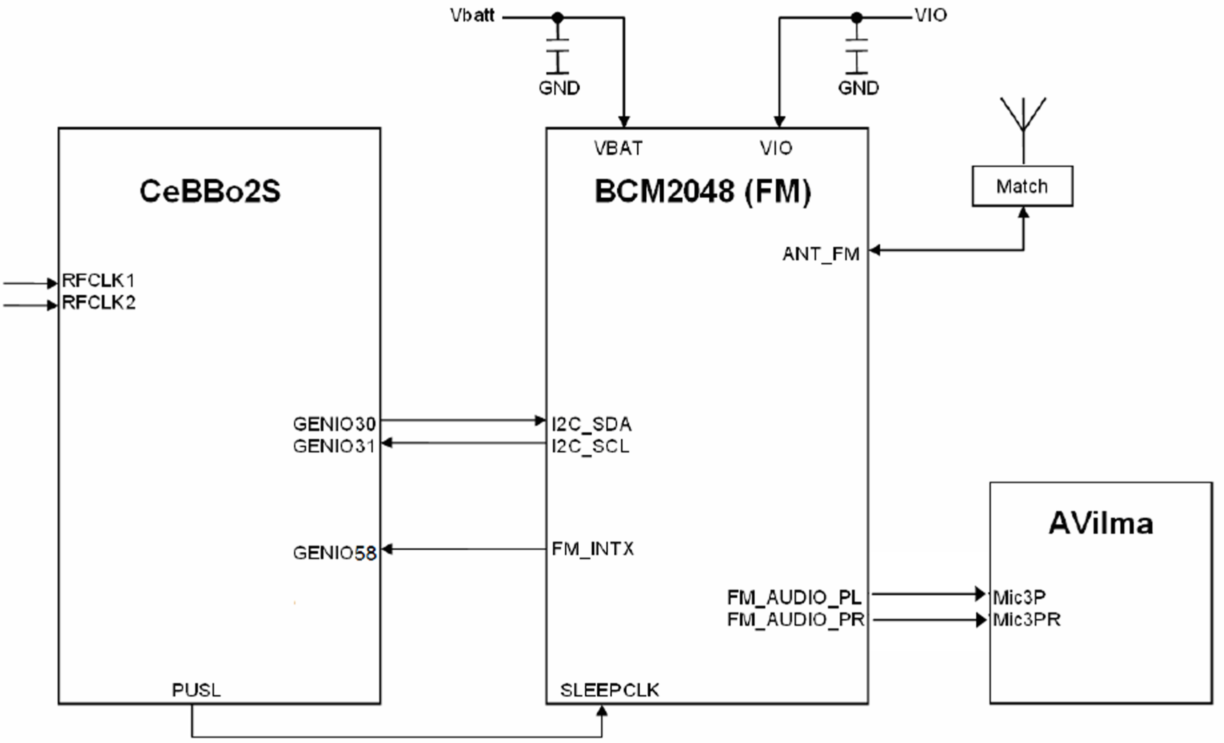

Vbatt
GND
GND
VIO
VBAT
VIO
BCM2048 (FM)
CeBBo2S
Match
ANT_FM
RFCLK1
RFCLK2
GENIO30
GENIO31
I2C_SDA
I2C_SCL
GENIO58
FM_INTX
AVilma
FM_AUDIO_PL
FM_AUDIO_PR
Mic3P
Mic3PR
PUSL
SLEEPCLK

Figure 34 FM interface

The FM radio is an integrated circuit, controlled by MCU software via the I2C bus. The wires of the headset are used as elements of the antenna, and no other antenna is needed for FM radio reception.

The radio has an automatic band search function, which can search for a strong station.

WLAN system overview (RM-399)

The WLAN Size4.0 solution is a fully integrated wireless radio solution based on TI TNET1251. The module includes the single chip transceiver, PM solution and the FEM. The module itself is manufactured by Panasonic using standard FR4 substrate.

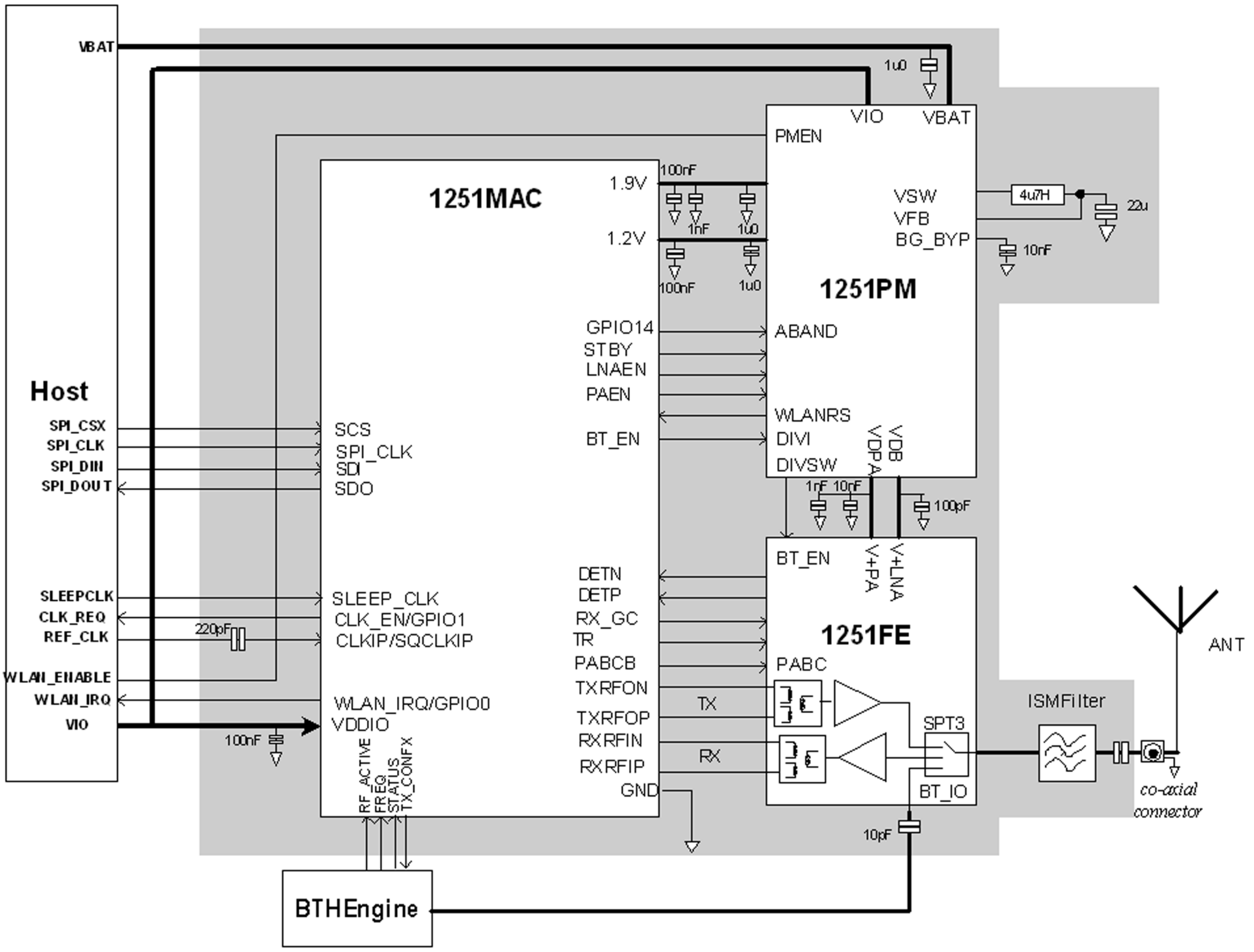

VBAT
Host
SPI_CSX
SPI_CLK
SPI_DIN
SPI_DOUT
SLEEPCLK
CLK_REQ
REF_CLK
WLAN_ENABLE
WLAN_IRQ
VIO
220pF
100nF
1251MAC
1.9V
1.2V
100nF
1nF
1u0
100nF
1u0
SCS
SPI_CLK
SDI
SDO
GPIO14
STBY
LNAEN
PAEN
BT_EN
SLEEP_CLK
CLK_EN/GPIO1
CLKIP/SQCLKIP
WLAN_IRQ/GPIO0
VDDIO
RF_ACTIVE
FREQ
STATUS
TX_CONFX
DETN
DETP
RX_GC
TR
PABCB
TXRFON
TXRFOP
RXRFIN
RXRFIP
GND
TX
RX
1u0
VIO
VBAT
PMEN
VSW
VFB
BG_BYP
4u7H
22u
10nF
1251PM
ABAND
WLANRS
DIVI
DIVSW
VDB
VDPA
1nF
10nF
100pF
BT_EN
V+PA
V+LNA
1251FE
PABC
SPT3
BT_IO
10pF
ANT
ISMFilter
co-axial connector
BTHEngine

Figure 35 WLAN block diagram

Functional description

The WLAN Size 4.0 module is a single component Wireless Local Area Network (WLAN) radio access technology supporting the IEEE 802.11 standards, for low error rate data transfer between mobiles and WLAN networks. It incorporates a highly optimised WLAN chipset for mobile applications where low cost, small physical size and low power consumption are important attributes.

The Size 4.0 module houses a medium access controller (MAC) spread spectrum baseband processor with direct conversion radio interface, a 2.4GHz RF Front End chip and Power Management (PM) IC. Data rates up to 54Mbps are possible in 802.11g mode of operation.

The Front end chip provides low noise power amplification, power detection and RF switching functions. It also provides an extra RF port, so that Bluetooth can operate and share the antenna with WLAN.

The baseband processor includes the direct conversion radio stage and MAC. The radio is responsible for the modulation and demodulation of data and scrambling/encoding of data according to information supplied by the MAC. The power management IC provides power to the baseband processor and FE. It incorporates an SMPS and linear regulators allowing the WLAN to operate directly from the cellular phone battery.

The WLAN SW is downloaded from the host engine when the WLAN is turned on, over the dedicated SPI interface.

The 38.4 MHz reference clock from the host engine is shared with other radio technologies (e.g. Bluetooth) and WLAN uses the clock request signal to request the reference clock to be turned on when WLAN needs to use it.

Camera concept

Camera

The device has one integrated camera with a SMIA65 2Mpix camera module. The camera is connected directly to the baseband, no hardware accelerator is used. Processing of the image is done by phone processor using NIPS (Nokia Imaging Perfection System) algorithms.

The CCI-bus (Camera Command Interface) is an I2C-compatible interface that is used bidirectional to transfer commands from BB to camera and to get information of camera register settings from camera to BB.

The CCP-bus (Compact Camera Port) is a unidirectional interface that is used to transfer the image data from camera to BB. It is a high speed differential interface. The camera is equipped with CCP class2 interface, i.e. up to 650Mbit/s. The device baseband supports CCP class0 (specified up to 208MHz) but limits the frequency to 160MHz.

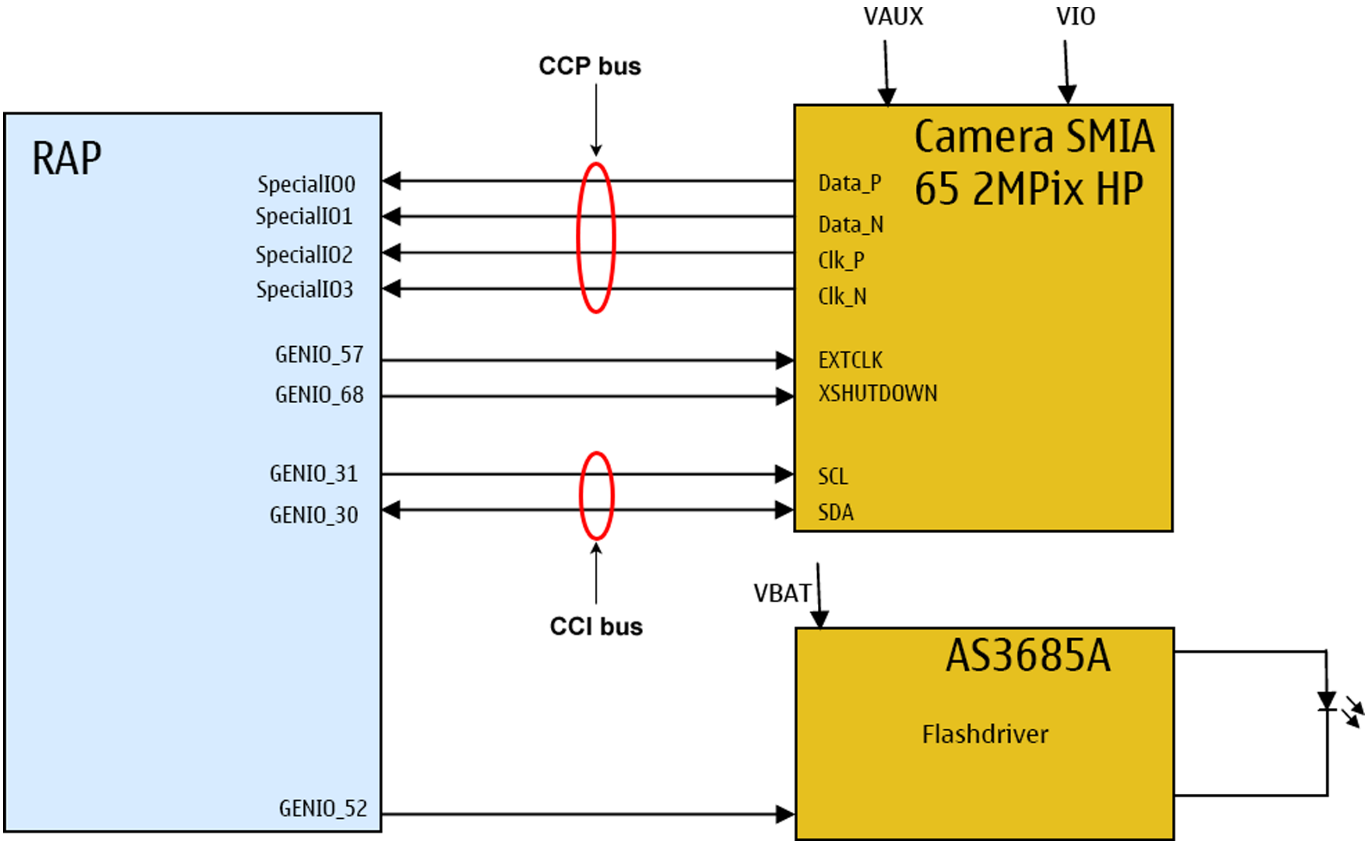

VAUX
VIO
CCP bus
RAP
SpecialIO0
SpecialIO1
SpecialIO2
SpecialIO3
GENIO_57
GENIO_68
GENIO_31
GENIO_30
GENIO_52
Camera SMIA 65 2MPix HP
Data_P
Data_N
Clk_P
Clk_N
EXTCLK
XSHUTDOWN
SCL
SDA
CCI bus
VBAT
AS3685A
Flashdriver

Figure 36 Camera concept

Camera flash

The device has a LED flash located next to the camera. The key components of the camera flash are:

- Flash LED
- Fresnel lens (integrated into flash window).

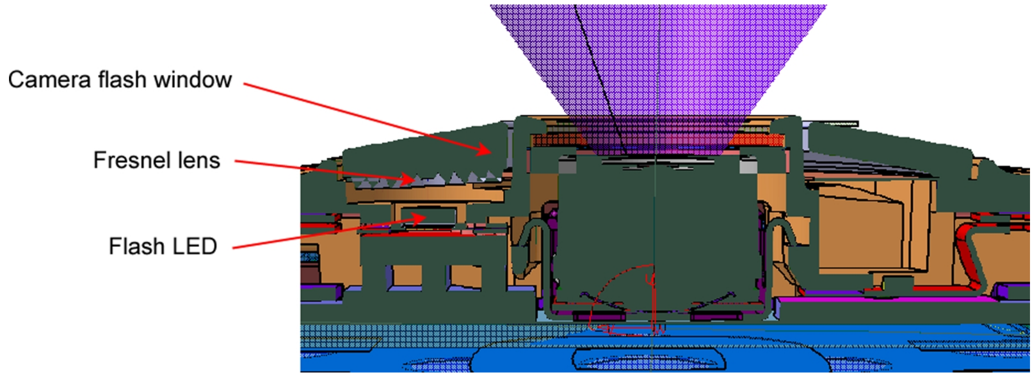

Camera flash window
Fresnel lens
Flash LED

Figure 37 Camera flash main components

The flash LED (V1002) is located on the top side of the UI flex.

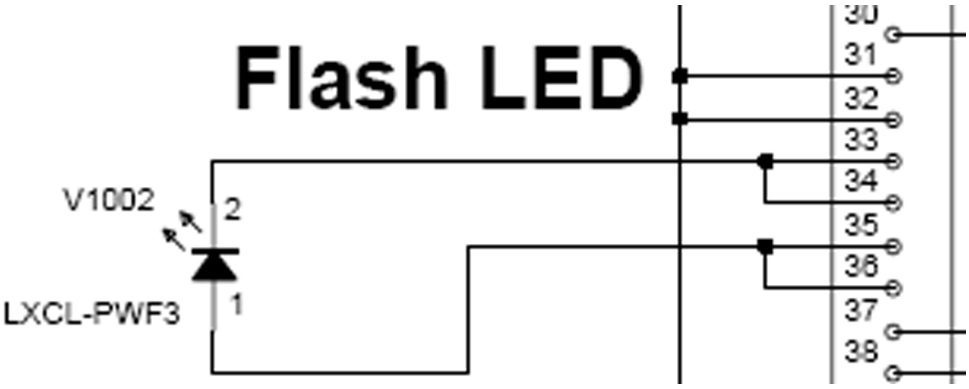

Flash LED
V1002
LXCL-PWF3
2
1
30
31
32
33
34
35
36
37
38

Figure 38 Camera flash LED design

The flash LED driver (D3350) is located on the main PWB.

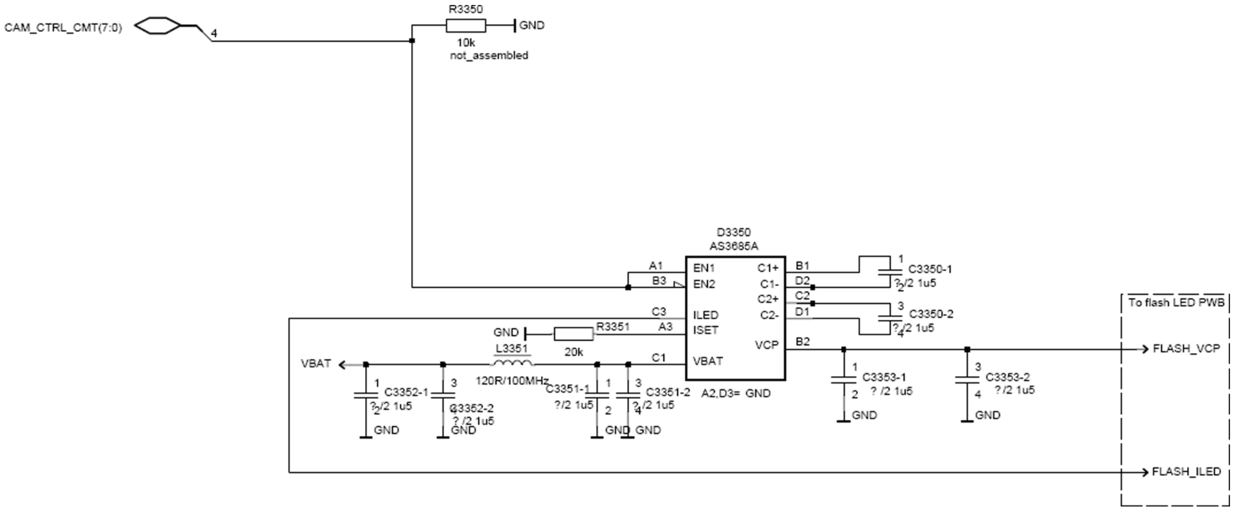

CAM_CTRL_CMT(7:0)
4
R3350
GND
10k
not_assembled
D3350
AS3685A
A1
B3
EN1
EN2
C1+
C1-
C2+
C2-
B1
D2
C2
D1
C3350-1
?/2 1u5
C3350-2
?/2 1u5
C3
A3
ILED
ISET
GND
R3351
20k
L3351
120R/100MHz
C1
VBAT
VCP
B2
VBAT
C3352-1
?/2 1u5
C3352-2
? /2 1u5
C3351-1
?/2 1u5
C3351-2
?/2 1u5
A2,D3= GND
C3353-1
? /2 1u5
C3353-2
? /2 1u5
GND
To flash LED PWB
FLASH_VCP
FLASH_ILED

Figure 39 Camera flash LED driver design

User interface

Display module

Display module

The display module consists of two different displays:

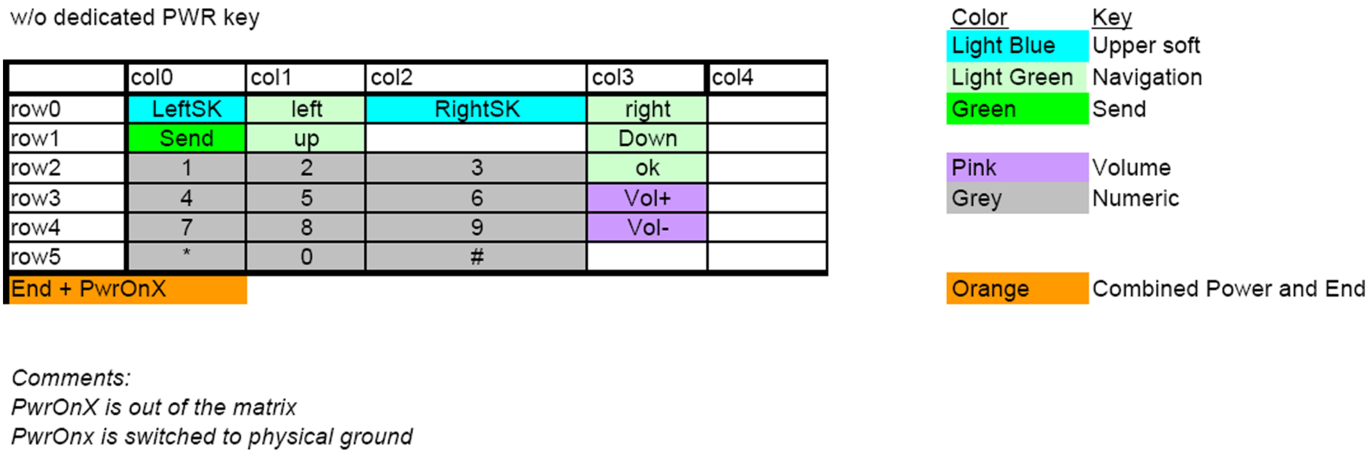
- A main 2.2" 240 x 320 TFT display with 16M colors
- A secondary 1.36" 128 x 160 TFT monochrome display.

The main display is only on when the phone is open, and the secondary display is only on when the phone is closed.

The interconnection between the display module and RAP engine is implemented with a 24-pin board-to-board connector. The display module is equipped with a driver with bi-directional 8-bit parallel interfaces.

If one of the displays is found to be faulty, the entire display module must be replaced.

Keyboard



w/o dedicated PWR key

	col0	col1	col2	col3	col4
row0	LeftSK	left	RightSK	right	
row1	Send	up		Down	
row2	1	2	3	ok	
row3	4	5	6	Vol+	
row4	7	8	9	Vol-	
row5	*	0	#		
End + PwrOnX					

Color	Key
Light Blue	Upper soft
Light Green	Navigation
Green	Send
Pink	Volume
Grey	Numeric
Orange	Combined Power and End

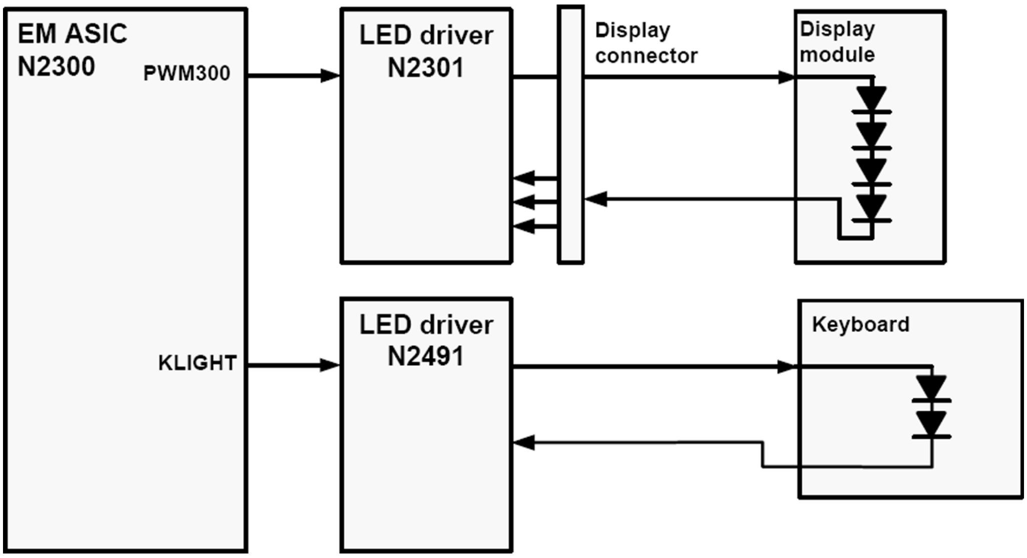
Comments:
PwrOnX is out of the matrix
PwrOnx is switched to physical ground

Figure 40 Keypad matrix

Backlights and illumination

Both main and secondary displays are backlit with 4 white LEDs.

The keypad is top lit by 2 LEDs.



Reminder light

The device has a reminder light , which blinks smoothly when the secondary display is turned off.

The reminder LED (V1001) is located on the top side of the UI flex.

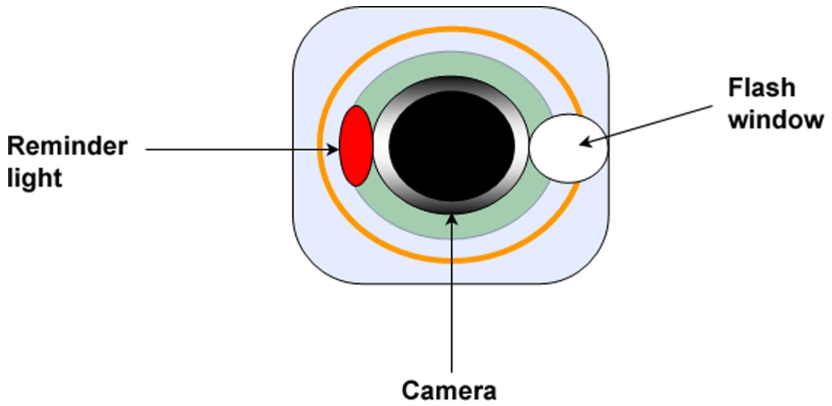

Reminder light
Flash window
Camera

Figure 41 Reminder light front view

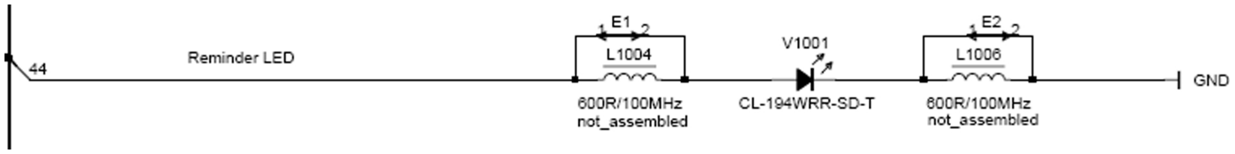

44
Reminder LED
E1
1
2
L1004
600R/100MHz
not_assembled
V1001
CL-194WRR-SD-T
E2
1
2
L1006
600R/100MHz
not_assembled
GND

Figure 42 Reminder light design

The reminder LED is controlled by the LED driver (N2491) located on the main PWB.

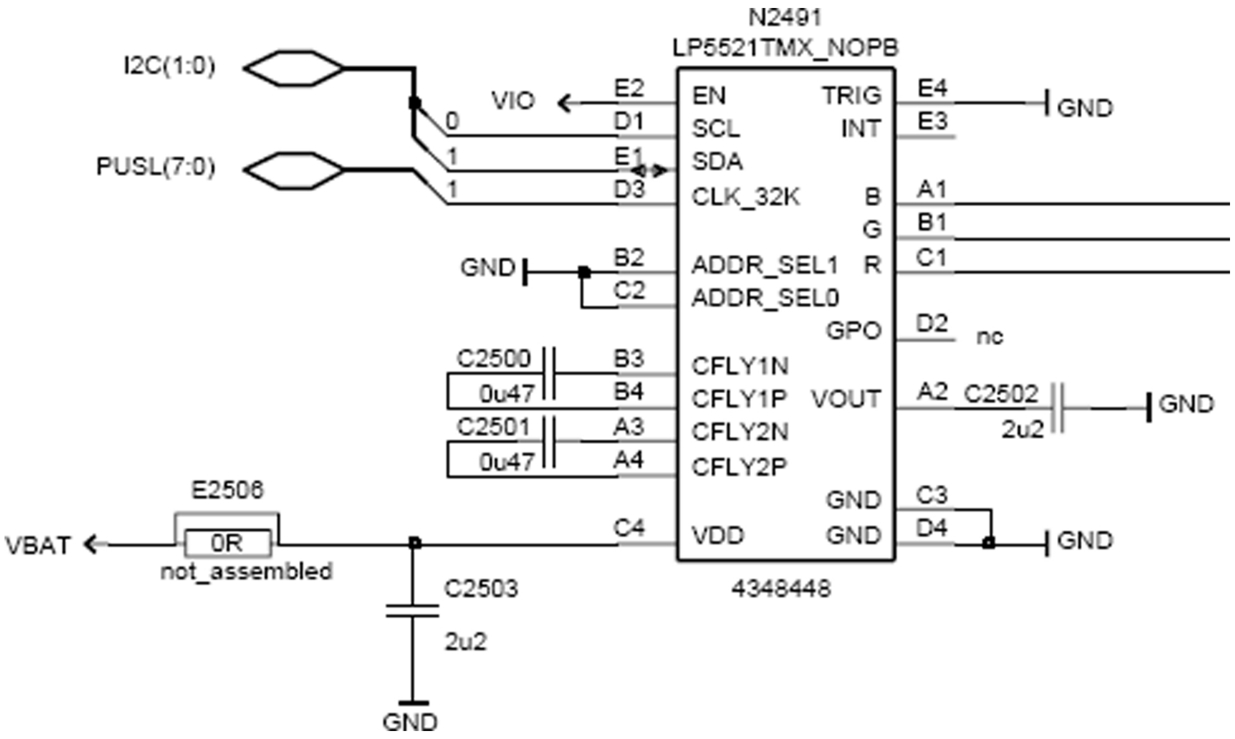

N2491
LP5521TMX_NOPB
I2C(1:0)
PUSL(7:0)
VIO
0
1
1
E2
D1
E1
D3
EN
SCL
SDA
CLK_32K
TRIG
INT
B
G
R
E4
E3
GND
A1
B1
C1
GND
B2
C2
ADDR_SEL1
ADDR_SEL0
GPO
D2
nc
C2500
0u47
C2501
0u47
B3
B4
A3
A4
CFLY1N
CFLY1P
CFLY2N
CFLY2P
VOUT
A2
C2502
2u2
GND
E2506
VBAT
0R
not_assembled
C4
VDD
GND
GND
C3
D4
GND
C2503
2u2
GND
4348448

Figure 43 N2491 LED driver design

Hall sensor

This fold form factor device has a hall sensor (N2405) that is used to detect open/close state of the phone. The hall sensor is mounted on the top side of the main board, and it operates together with a small magnet fitted to the upper block. The output signal from the hall sensor is active low (0V), and 1.8V when it is not active.

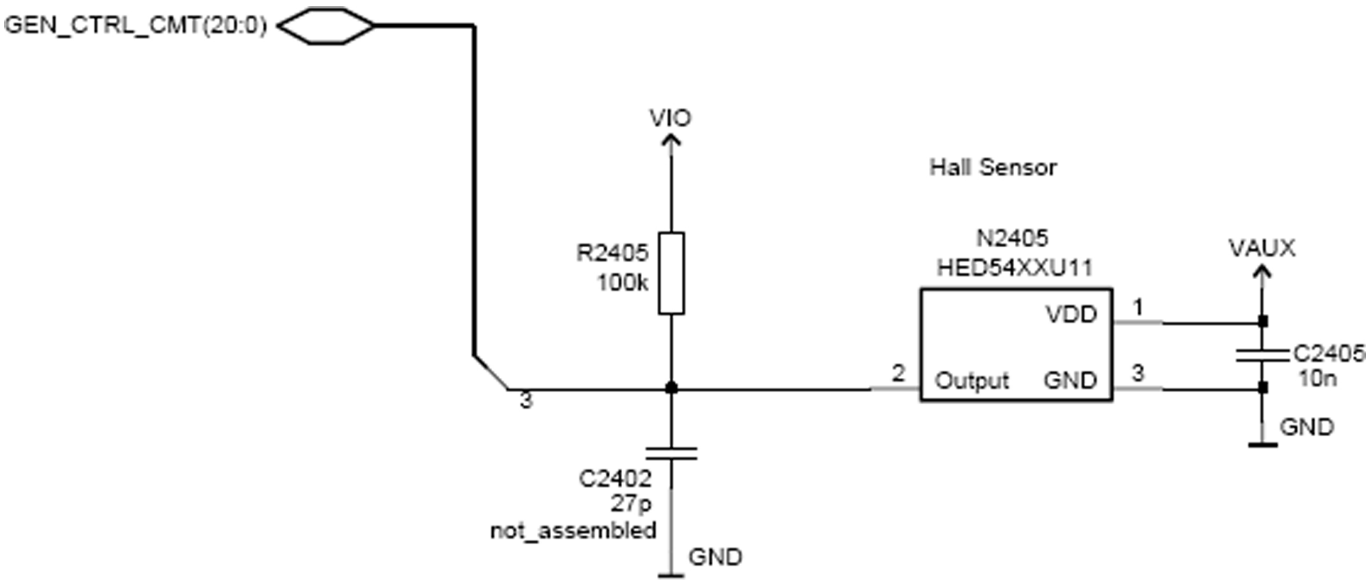

GEN_CTRL_CMT(20:0)
VIO
Hall Sensor
R2405
100k
N2405
HED54XXU11
VAUX
VDD
1
2
Output
GND
3
C2405
10n
GND
3
C2402
27p
not_assembled
GND

Figure 44 Hall sensor design

Combo memory

The combo memory (D3000) is stacked on top of RAPS. The combo itself consists of a 256 Mbit DDR SDRAM die stacked on top of a 512 Mbit NOR flash memory in a POP2 package.

The RAPS memory connections support NOR flash densities up to 2x512 Mbit, DDR SDRAM densities up to 512 Mbit, and Mass Memory densities of several gigabits.

Audio

Audio concept

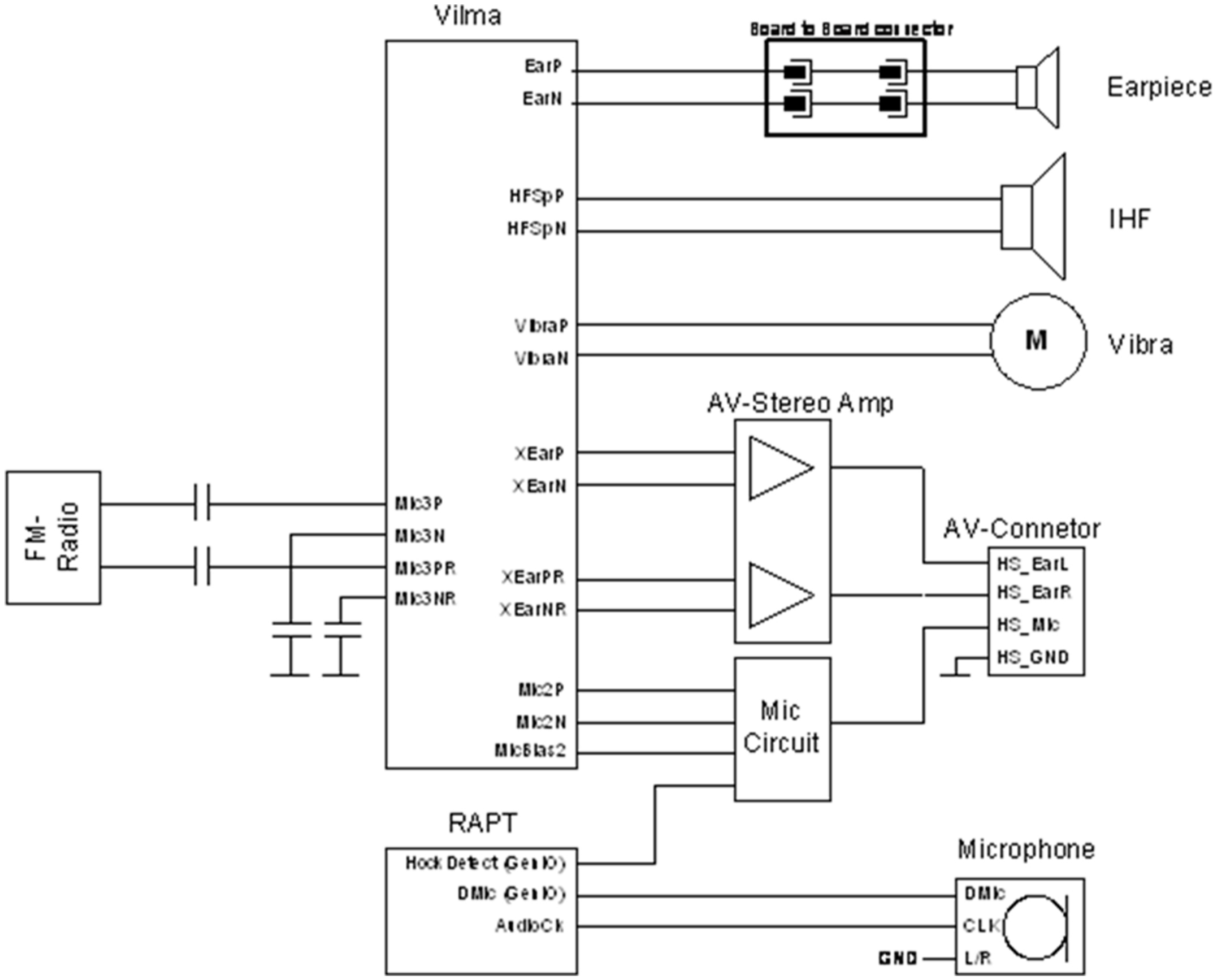

Vilma
Board to Board connector
EarP
EarN
Earpiece
HFSpP
HFSpN
IHF
VibraP
VibraN
M
Vibra
AV-Stereo Amp
XEarP
XEarN
FM-Radio
Mic3P
Mic3N
Mic3PR
Mic3NR
XEarPR
XEarNR
AV-Connetor
HS_EarL
HS_EarR
HS_Mic
HS_GND
Mic2P
Mic2N
MicBias2
Mic Circuit
RAPT
Hook Detect (GenIO)
DMic (GenIO)
AudioClk
Microphone
DMic
CLK
L/R
GND

Figure 45 Audio block diagram

Internal microphone

The digital internal microphone (B2150) is located at the bottom side of the main board. To save current when the microphone is not needed, its supply voltage is controlled by VSIM2. The Data and Clk lines are directly connected to RAPS.

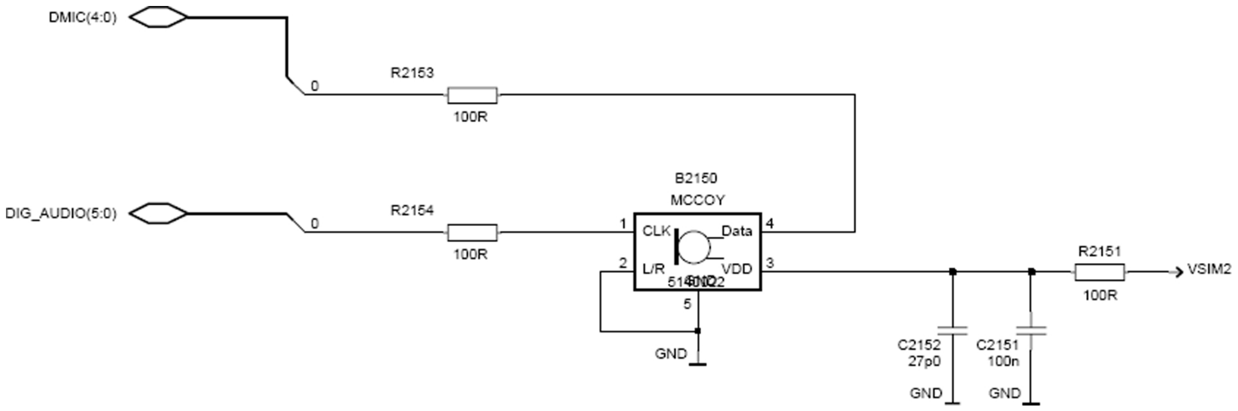

DMIC(4:0)
0
R2153
100R
DIG_AUDIO(5:0)
0
R2154
100R
B2150
MCCOY
CLK
Data
L/R
VDD
1
2
3
4
5
514002
GND
R2151
100R
VSIM2
C2152
27p0
C2151
100n
GND
GND

Figure 46 Internal microphone

Internal earpiece

The internal earpiece (B1000) is located at the bottom side of the UI flex. The earpiece is directly driven by the internal ear amplifiers of the AVILMA and no additional amplifier is used.

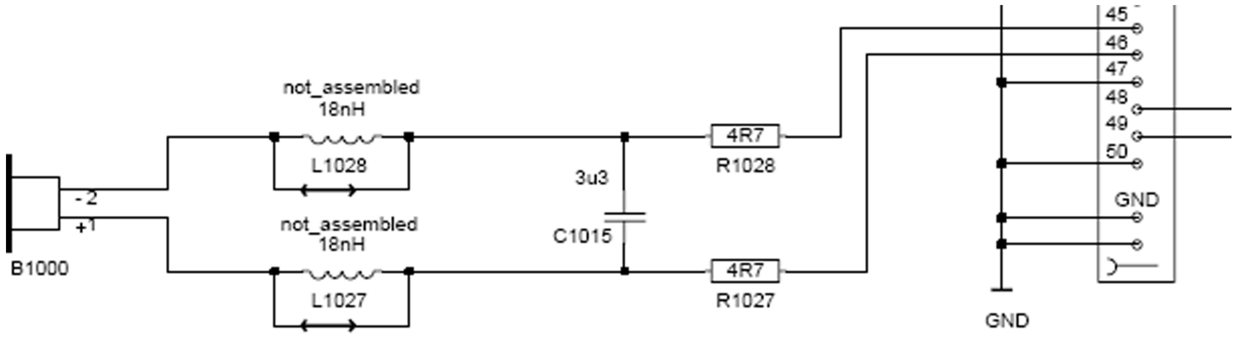

B1000
-2
+1
not_assembled
18nH
L1028
not_assembled
18nH
L1027
3u3
C1015
4R7
R1028
4R7
R1027
45
46
47
48
49
50
GND
GND

Figure 47 Internal earpiece

IHF speaker

The IHF speaker (E2165/E2166) is located at the bottom side of the main board. No additional amplifier is used.

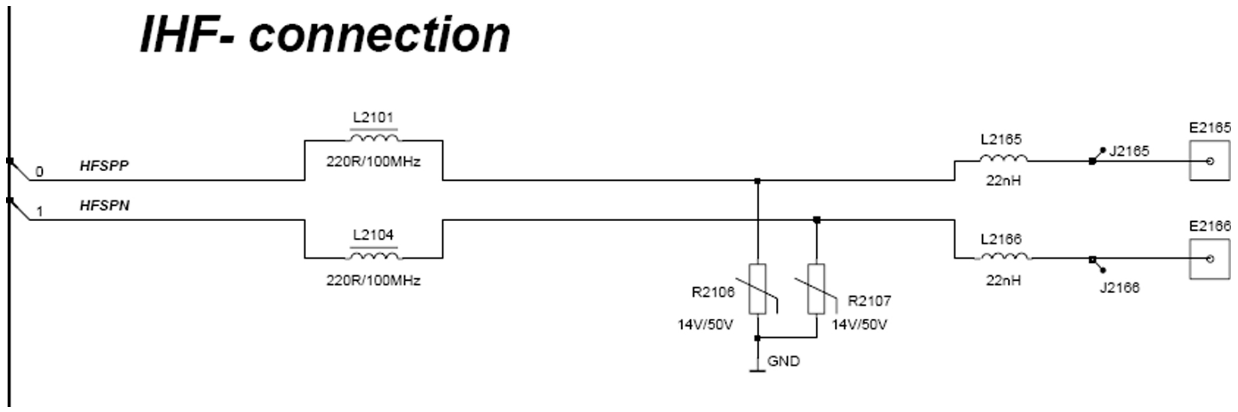
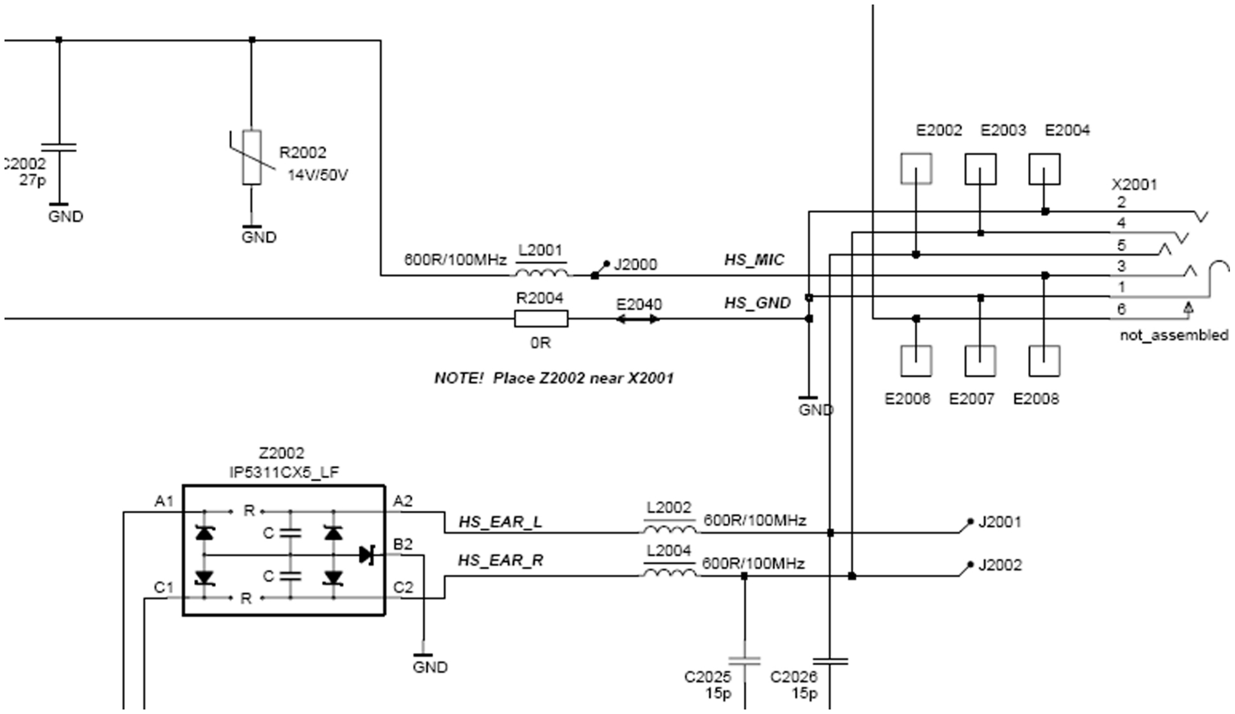

IHF- connection
0
HFSPP
1
HFSPN
L2101
220R/100MHz
L2104
220R/100MHz
R2106
14V/50V
R2107
14V/50V
GND
L2165
22nH
L2166
22nH
J2165
J2166
E2165
E2166

Figure 48 IHF speaker

External microphone

An external microphone can be connected to the device via the 2.5mm AV connector (X2001) located at the bottom side of the main board. The external microphone connection is able to use ECI data as well. Thus an analogue switch is applied to the path. The switch is controlled by GenIO 43.

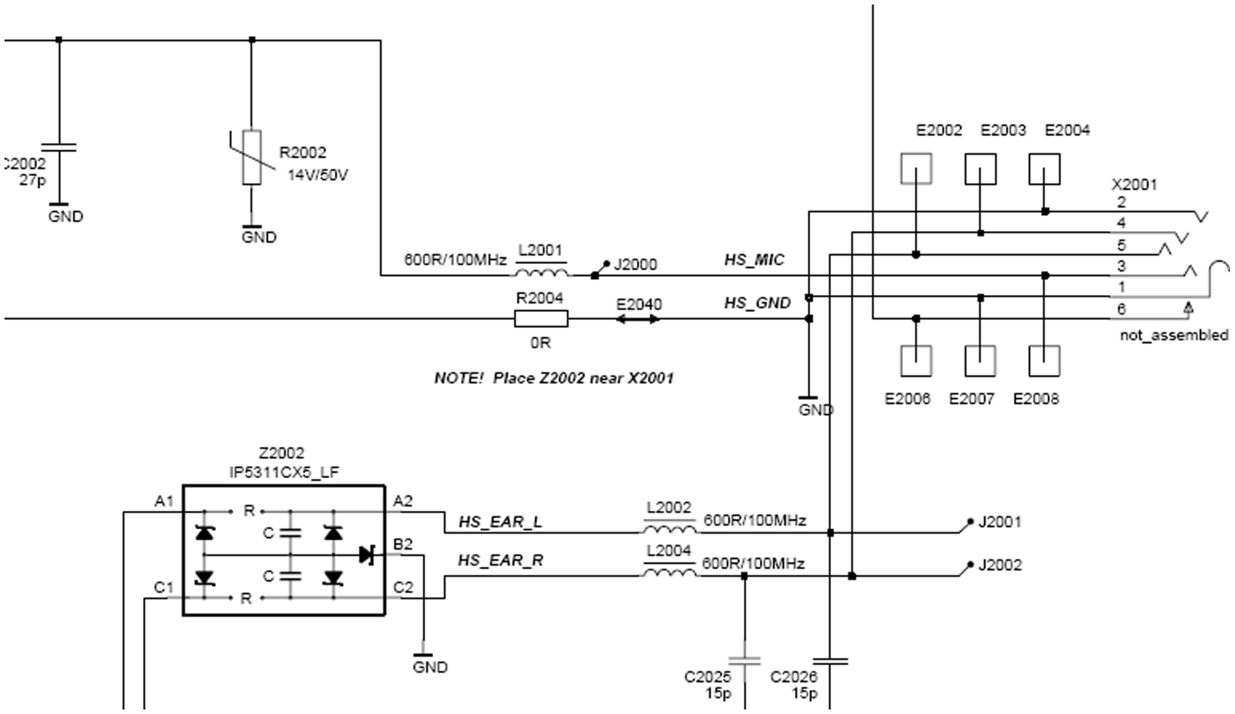


2002
27p
GND
R2002
14V/50V
GND
600R/100MHz
L2001
J2000
HS_MIC
R2004
0R
E2040
HS_GND
NOTE! Place Z2002 near X2001
GND
E2002
E2003
E2004
X2001
2
4
5
3
1
6
not_assembled
E2006
E2007
E2008
Z2002
IP5311CX5_LF
A1
R
C
C
R
C1
A2
B2
C2
GND
HS_EAR_L
HS_EAR_R
L2002
600R/100MHz
L2004
600R/100MHz
J2001
J2002
C2025
15p
C2026
15p

Figure 49 AV connector

External earpiece

An external earpiece can be connected to the device via the 2.5mm AV connector (X2001) located at the bottom side of the main board. TPA6130 (N2000), located at the bottom side of the main board, is needed for the AV interface as a power amplifier with volume control. This analogue stereo amplifier may be controlled via the I^{2}C for volume adjustment and setup of the output channels.



2002
27p
GND
R2002
14V/50V
GND
600R/100MHz
L2001
J2000
HS_MIC
R2004
0R
E2040
HS_GND
NOTE! Place Z2002 near X2001
GND
E2002
E2003
E2004
X2001
2
4
5
3
1
6
not_assembled
E2006
E2007
E2008
Z2002
IP5311CX5_LF
A1
R
C
C
R
C1
A2
B2
C2
GND
HS_EAR_L
HS_EAR_R
L2002
600R/100MHz
L2004
600R/100MHz
J2001
J2002
C2025
15p
C2026
15p

Figure 50 AV connector

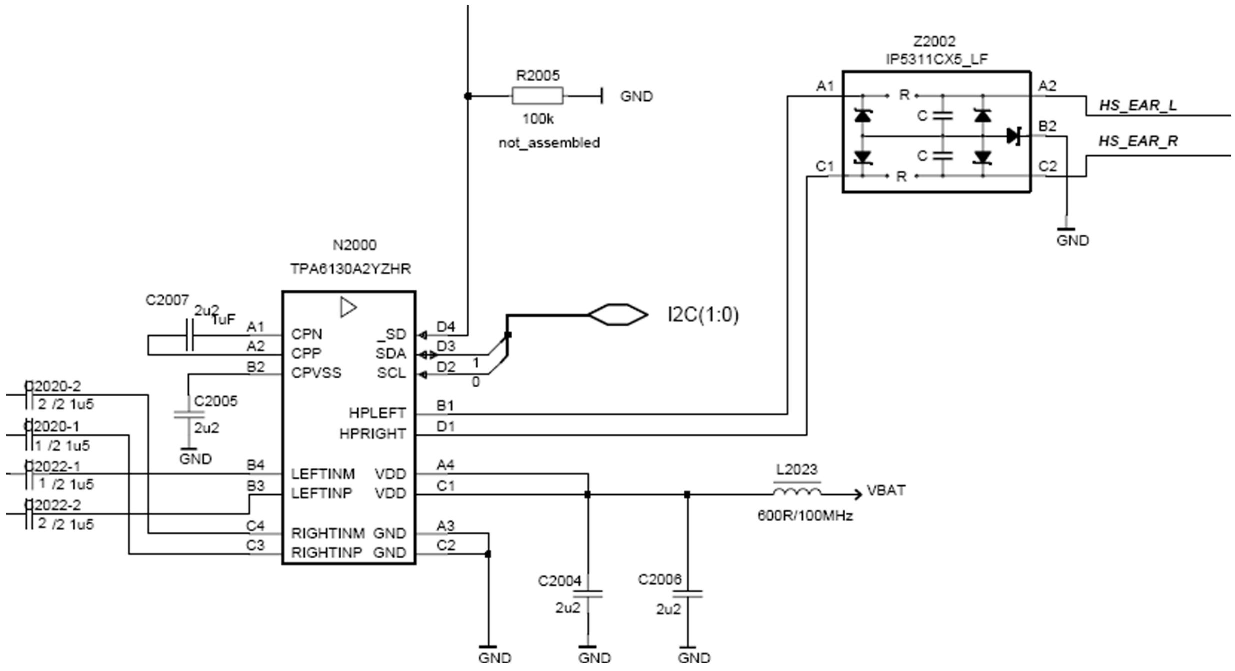

R2005
100k
not_assembled
GND
Z2002
IP5311CX5_LF
A1
A2
B2
C1
C2
R
C
HS_EAR_L
HS_EAR_R
GND
N2000
TPA6130A2YZHR
C2007
2u2
1uF
A1
A2
B2
CPN
CPP
CPVSS
_SD
SDA
SCL
D4
D3
D2
1
0
I2C(1:0)
C2020-2
2 /2 1u5
C2020-1
1 /2 1u5
C2022-1
1 /2 1u5
C2022-2
2 /2 1u5
C2005
2u2
GND
HPLEFT
HPRIGHT
B1
D1
B4
B3
LEFTINM
LEFTINP
VDD
VDD
A4
C1
L2023
600R/100MHz
VBAT
C4
C3
RIGHTINM
RIGHTINP
GND
GND
A3
C2
C2004
2u2
C2006
2u2
GND
GND
GND

Figure 51 AV interface power amplifier TPA6130

Vibra

The vibra (M2101) is a mounted SMD located at the bottom side of the main board. It is supplied directly from AVILMA’s Vibra outputs.

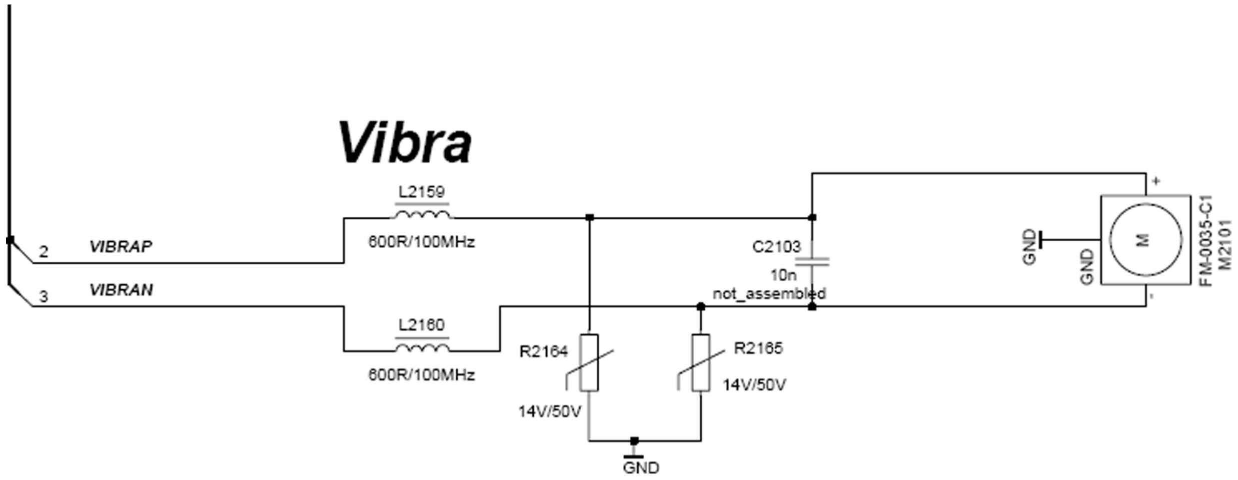

Vibra
L2159
600R/100MHz
2
VIBRAP
3
VIBRAN
L2160
600R/100MHz
C2103
10n
not_assembled
R2164
14V/50V
R2165
14V/50V
GND
+
-
M
GND
GND
FM-0035-C1
M2101

Figure 52 Vibra

RF description

RF block

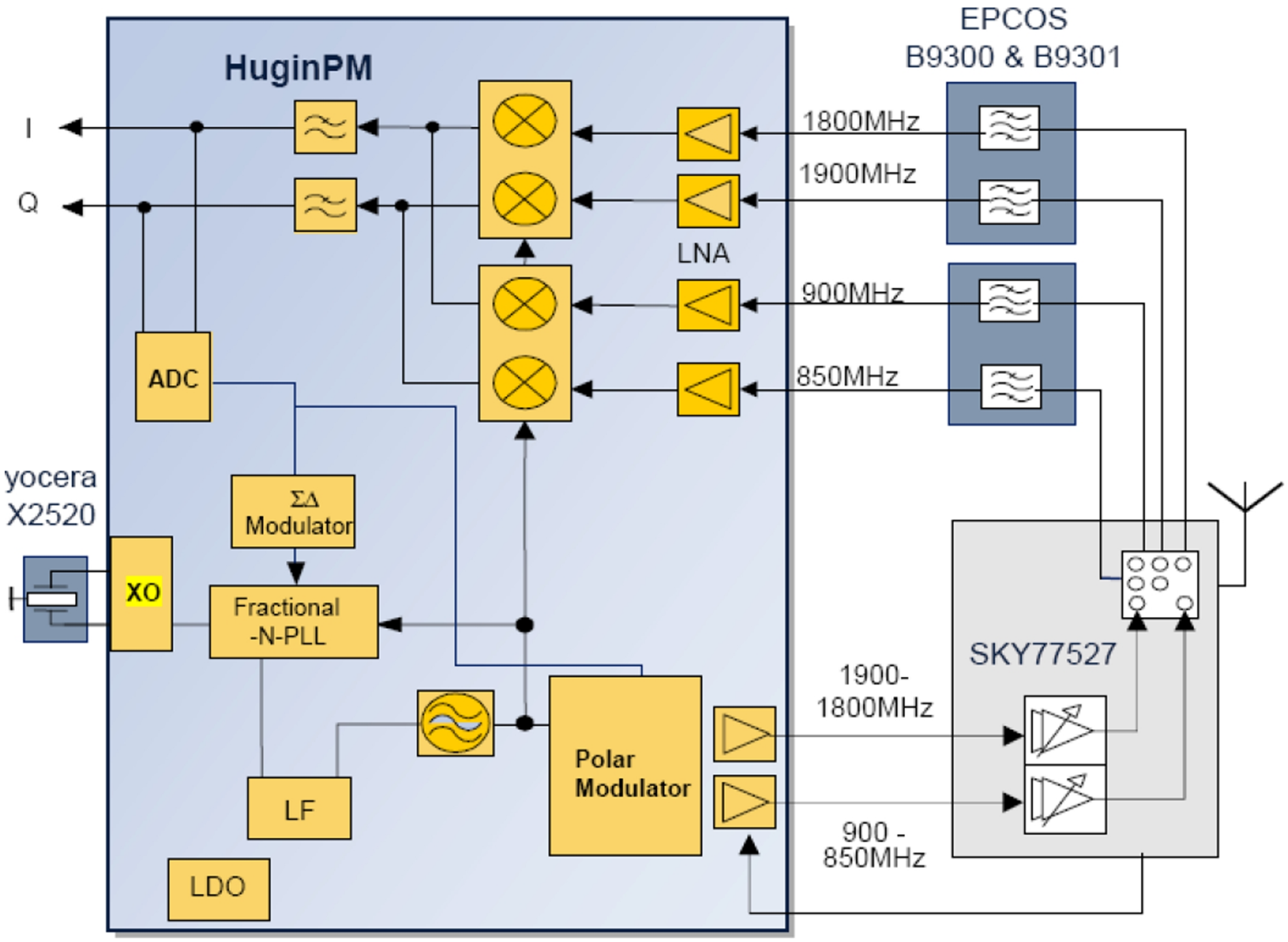

EPCOS
B9300 & B9301
HuginPM
I
Q
1800MHz
1900MHz
LNA
900MHz
850MHz
ADC
yocera
X2520
XO
ΣΔ
Modulator
Fractional
-N-PLL
SKY77527
1900-
1800MHz
Polar
Modulator
900 -
850MHz
LF
LDO

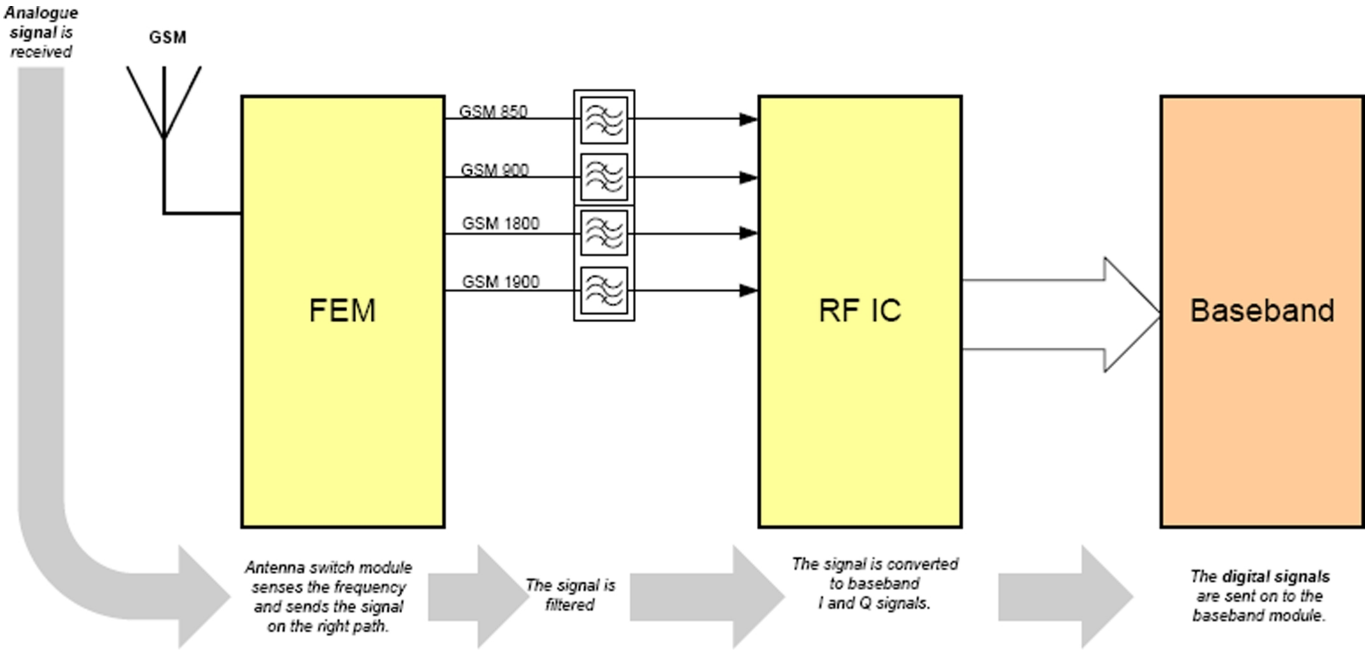
Figure 53 RF block diagram

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

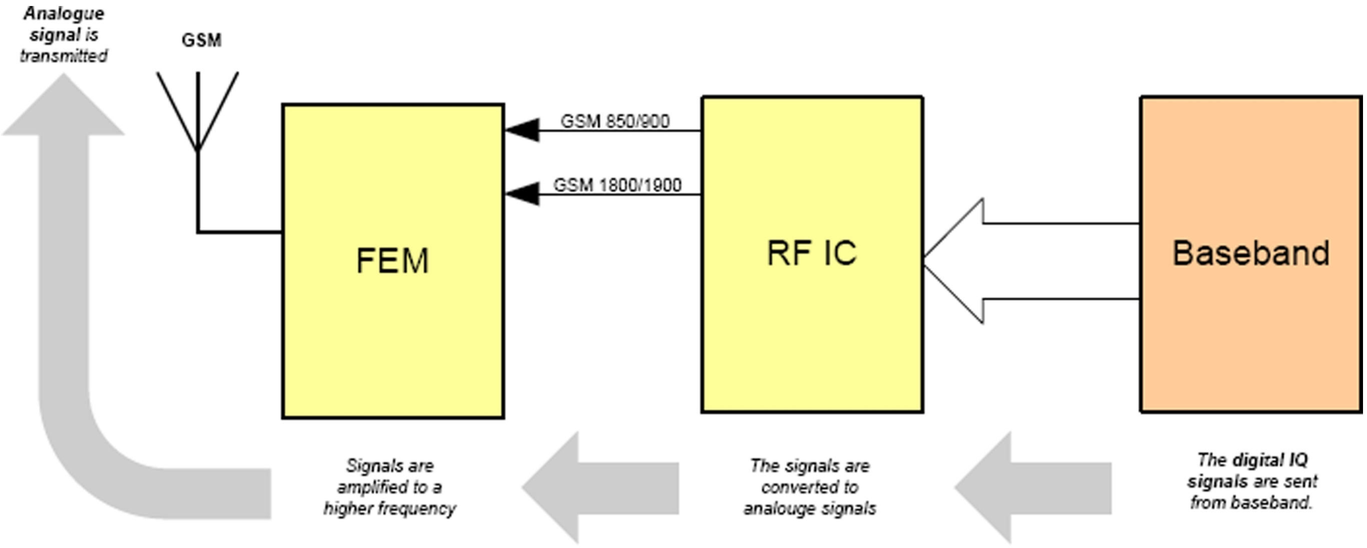
Signals with different frequencies take different paths, therefore being handled by different components.


Analogue signal is received
GSM
GSM 850
GSM 900
GSM 1800
GSM 1900
FEM
RF IC
Baseband
Antenna switch module senses the frequency and sends the signal on the right path.
The signal is filtered
The signal is converted to baseband I and Q signals.
The digital signals are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwidth of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.


Analogue signal is transmitted
GSM
GSM 850/900
GSM 1800/1900
FEM
RF IC
Baseband
Signals are amplified to a higher frequency
The signals are converted to analouge signals
The digital IQ signals are sent from baseband.

Glossary

(This page left intentionally blank.)

A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared

IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency

RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator

VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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